ADITYA ENGINEERING COLLEGE

An Autonomous Institutuion

Approved by AICTE • Permanently Affiliated to JNTUK • Accredited by NAAC with 'A' Grade

Recognised by UGC under sections 2(f) and 12(B) of UGC Act, 1956

Aditya Nagar, ADB Road, Surampalem - 533437, Near Kakinada, E.G.Dt., Ph:99498 76662

Program Name : B.Tech. in Civil Engineering

Syllabus Revision for the Academic Year 2021-2022

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
1	I	201HS1T01	Communicative English	0
2	I	201BS1T01	Differential equations and Linear algebra	0
3	I	201BS1T03	Engineering Physics	0
4	I	201ES1T02	Building Materials & Construction	0
5	I	201ES1I01	Engineering Graphics	0
6	I	201HS1L01	Communicative English Lab	0
7	I	201BS1L02	Engineering Physics Lab	0
8	I	201ES1L02	Engineering Workshop	0
9	I	201MC1T01	Environmental Science	0
10	II	201BS2T05	Partial Differential Equations and Vector Calculus	0
11	II	201BS2T06	Chemistry of Materials	0
12	II	201ES2T07	Engineering Mechanics	0
13	II	201ES2T09	Programming for Problem Solving Using C	0
14	II	201ES2T13	Surveying	0
15	II	201ES2L06	Surveying field Work	0
16	II	201ES2L09	Engineering Chemistry Lab	0

17	II	201ES2L11	Programming for Problem Solving Using C Lab	0
18	II	201MC2L01	Professional communications skills Lab	0
19	II	201MC2T02	Constitution of India	0
20	III	201BS3T12	Integral transforms and applications of Partial Differential Equations	0
21	III	201CE3T01	Strength of Materials-I	0
22	III	201CE3T02	Fluid Mechanics	0
23	III	201CE3T03	Structural Analysis	0
24	III	201CE3T04	Concrete Technology	0
25	III	201CE3L01	Building Planning & Drawing Lab	0
26	III	201CE3L02	Concrete Technology Lab	0
27	III	201CE3L03	Strength of Materials Lab	0
28	III	201SC3L01	CAD Lab	100
29	III	201MC3T03	Biology for Engineers	0
30	IV	201BS4T15	Numerical Methods and Statistical Techniques	0
31	IV	201CE4T05	Engineering Geology	0
32	IV	201CE4T06	Strength of Materials-II	0
33	IV	201CE4T07	Hydraulics & Hydraulic Machinery	0
34	IV	201HS4T02	Management Science	0
35	IV	201CE4T08	Soil Mechanics	0
36	IV	201CE4L04	Engineering Geology Lab	0
37	IV	201CE4L05	FM & HM Lab	0
38	IV	201SC4L13	3D Modeling using Revit	100

39	IV	201MC4T04	Essence of Indian Traditional Knowledge	0
40	V	191CE5T09	Irrigation & water resource Engineering	33
41	V	191CE5T10	Engineering geology	0
42	V	191CE5T11	Design & drawing of Reinforced concrete structures	0
43	V	191CE5T12	Geotechnical engineering	0
44	V	191CE5E02	PE I Construction Technology & Management	50
45	V	191CE5E04	Subsurface Investigation and Instrumentation	100
46	V	191CE5E01	Airport Planning and Design	100
47	V	191CE5E05	Urban Hydrology	17
48	V	191CE5E03	Environmental Pollution and Control	100
49	V	191EE5O01	OE I Electrical Safety	100
50	V	191EE5O02	Electrical Materials	100
51	V	191EE5O03	Basic Electrical Measurements	100
52	V	191ME5O02	Fundamentals of Mechanical Engineering	100
53	V	191ME5O03	Supply Chain Management	100
54	V	191ME5O04	3D Printing	100
55	V	191ME5O05	Entrepreneurship Development and Incubation	100
56	V	191EC5O01	Signals & Systems	100
57	V	191EC5O02	Digital Electronics and Logic Design	100
58	V	191EC5O03	Semi conductor devices	100
59	V	191CS5O01	Data Structures	100
60	V	191CS5O02	Object Oriented Programming through C++	100

61	V	191CS5O03	Java Programming	100
62	V	191CS5O04	R Programming	100
63	V	191IT5O01	Data Base Management Systems	100
64	V	191IT5O02	Computer Graphics	100
65	V	191MI5O01	Overview of Mining	100
66	V	191PT5O01	Process Intensification in Petroleum Industry	100
67	V	191PT5O02	Fundamentals of Petroleum Industry	100
68	V	191AG5O01	Basic Crop Production Practices	100
69	V	191CE5L05	Engineering geology lab	0
70	V	191CE5L06	Geotechnical engineering lab	0
71	V	191HS5T06	Employability Skills - III	0
72	V	191PR5P02	Socially Relevant Project	100
73	V	191MC5A07	Survey camp	0
74	VI	191CE6T13	Design & drawing of steel Structures	0
75	VI	191CE6T14	Highway engineering	0
76	VI	191CE6T15	Foundation engineering	0
77	VI	191CE6E10	PE-II Repair and Rehabilitation of Structures	0
78	VI	191CE6E07	Ground Improvement Techniques	0
79	VI	191CE6E09	Railway Engineering	100
80	VI	191CE6E08	Hydropower Development	100
81	VI	191CE6E06	Air Pollution Engineering	0
82	VI	191CE6E13	PE -III Finite Element Methods	0

83	VI	191CE6E12	Expansive Soils	100
84	VI	191CE6E11	Docks and Harbour Engineering	100
85	VI	191CE6E15	Water Resources System Analysis	100
86	VI	191CE6E14	Industrial Waste & Waste-Water Engineering	100
87	VI	191EE6O04	OE II Energy Audit and Conservation Management	100
88	VI	191EE6O05	Non Conventional Energy resources	100
89	VI	191EE6O06	Instrumentation	100
90	VI	191ME6O06	Solar Energy Utilisation	100
91	VI	191ME6O07	Basic Thermodynamics and Heat Transfer	100
92	VI	191ME6O09	3D Printing	100
93	VI	191ME6O06	Robotics	100
94	VI	191ME6O12	Entrepreneurship Development and Incubation	100
95	VI	191ME6O07	Biomedical Instrumentation	100
96	VI	191ME6O08	ECAD Tools	100
97	VI	191CS6O05	Python Programming	100
98	VI	191CS6O06	Operating Systems	100
99	VI	191CS6O07	Web Technologies	100
100	VI	191CS6O08	Cyber Security	100
101	VI	191CS6O09	AR / VR	100
102	VI	191IT6O03	Computer Organization	100
103	VI	191IT6O04	AI Tools & Techniques	100
104	VI	191AG6O03	Bio-energy systems design and applications	100

105	VI	191IT6O05	Robotic Process Automation	100
106	VI	191MI6O02	Industrial Safety Practices	100
107	VI	191MI6O03	Electrical Equipment's in Mines	100
108	VI	191PT6O03	Unconventional Hydrocarbon Resources	100
109	VI	191PT6O04	Asset Management	100
110	VI	191AG6O02	Weather forecast in Agriculture	100
111	VI	191CE6L07	Transportation engineering lab	0
112	VI	191CE6L08	Computer aided design lab	0
113	VI	191CE6L09	Irrigation design & drawing	0
114	VI	191HS6T07	Employability skills - IV	0
115	VII	171CE7T18	Geotechnical Engineering - II	0
116	VII	171CE7T19	Environmental Engineering	0
117	VII	171CE7T20	Remote Sensing and GIS Applications	0
118	VII	171CE7T21	Estimation, Specifications and Contracts	0
119	VII	171CE7E10	PE IV Advanced Structural Engineering	0
120	VII	171CE7E11	Watershed Management	0
121	VII	171CE7E12	Design of Tall Buildings	0
122	VII	171CE7E13	PE V Bridge Engineering	0
123	VII	171CE7E14	Environmental Impact Assessment and Management	0
124	VII	171CE7E15	Water Resources Systems Planning	0
125	VII	171CE7L08	Environmental Engineering Lab	0
126	VII	171CE7L09	GIS And Computer Aided Design (CAD) Lab	0

105	VI	191IT6O05	Robotic Process Automation	100
106	VI	191MI6O02	Industrial Safety Practices	100
107	VI	191MI6O03	Electrical Equipment's in Mines	100
108	VI	191PT6O03	Unconventional Hydrocarbon Resources	100
109	VI	191PT6O04	Asset Management	100
110	VI	191AG6O02	Weather forecast in Agriculture	100
111	VI	191CE6L07	Transportation engineering lab	0
112	VI	191CE6L08	Computer aided design lab	0
113	VI	191CE6L09	Irrigation design & drawing	0
114	VI	191HS6T07	Employability skills - IV	0
115	VII	171CE7T18	Geotechnical Engineering - II	0
116	VII	171CE7T19	Environmental Engineering	0
117	VII	171CE7T20	Remote Sensing and GIS Applications	0
118	VII	171CE7T21	Estimation, Specifications and Contracts	0
119	VII	171CE7E10	PE IV Advanced Structural Engineering	0
120	VII	171CE7E11	Watershed Management	0
121	VII	171CE7E12	Design of Tall Buildings	0
122	VII	171CE7E13	PE V Bridge Engineering	0
123	VII	171CE7E14	Environmental Impact Assessment and Management	0
124	VII	171CE7E15	Water Resources Systems Planning	0
125	VII	171CE7L08	Environmental Engineering Lab	0
126	VII	171CE7L09	GIS And Computer Aided Design (CAD) Lab	0

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PROGRAM STRUCTURE

I SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201HS1T01	Communicative English	HSMC	Theory	3	0	0	3	3
201BS1T01	Differential equations and Linear algebra	BSC	Theory	3	0	0	3	3
201BS1T02	Engineering Physics	BSC	Theory	3	0	0	3	3
201ES1T01	Building Materials & Construction	ESC	Theory	3	0	0	3	3
201ES1T05	Engineering Graphics	ESC	Theory	1	0	4	5	3
201HS1L01	Communicative English Lab	HSMC	Lab	0	0	3	3	1.5
201BS1L01	Engineering Physics Lab	BSC	Lab	0	0	3	3	1.5
201ES1L01	Engineering Workshop	ESC	Lab	0	0	3	3	1.5
201MC1T01	Environmental Science	MC	Theory	2	0	0	2	0
			TOTAL	15	0	13	28	19.5

II SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS2T05	Partial Differential Equations and Vector Calculus	BSC	Theory	3	0	0	3	3
201BS2T08	Chemistry of Materials	BSC	Theory	3	0	0	3	3
201ES2T06	Engineering Mechanics	ESC	Theory	3	0	0	3	3
201ES2T08	Programming for Problem Solving Using C	ESC	Theory	3	0	0	3	3
201ES2T12	Surveying	ESC	Theory	3	0	0	3	3
201ES2L05	Surveying field Work	ESC	Lab	0	0	3	3	1.5
201BS2L05	Engineering Chemistry Lab	BSC	Lab	0	0	3	3	1.5
201ES2L10	Programming for Problem Solving Using C Lab	ESC	Lab	0	0	3	3	1.5
201MC2L01	Professional Communications skills Lab	MC	Lab	0	0	3	3	0
201MC2T02	Constitution of India	MC	Theory	2	0	0	2	0
			TOTAL	17	0	12	29	19.5

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III SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS3T12	Integral Transforms and Applications of Partial Differential Equations	BSC	Theory	3	0	0	3	3
201CE3T01	Strength of Materials-I	PCC	Theory	3	0	0	3	3
201CE3T02	Fluid Mechanics	PCC	Theory	3	0	0	3	3
201CE3T03	Structural Analysis	PCC	Theory	3	0	0	3	3
201CE3T04	Concrete Technology	PCC	Theory	3	0	0	3	3
201CE3L01	Building Planning and Drawing Lab	PCC	Lab	0	0	3	3	1.5
201CE3L02	Concrete Technology Lab	PCC	Lab	0	0	3	3	1.5
201CE3L03	Strength of Materials Lab	PCC	Lab	0	0	3	3	1.5
201SC3L01	**Skill Oriented Course-I** Computer Aided Drafting Lab	SC	Lab	0	0	4	4	2
201MC3T03	Biology for Engineers	MC	Theory	2	0	0	2	0
			TOTAL	**17**	**0**	**13**	**30**	**21.5**

IV SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS4T15	Numerical Methods and Statistical Techniques	BSC	Theory	3	0	0	3	3
201CE4T05	Engineering Geology	PCC	Theory	3	0	0	3	3
201CE4T06	Strength of Materials-II	PCC	Theory	3	0	0	3	3
201CE4T07	Hydraulics and Hydraulic Machinery	PCC	Theory	3	0	0	3	3
201HS4T02	Management Science	HSMC	Theory	3	0	0	3	3
201CE4T08	Soil Mechanics	PCC	Theory	3	0	0	3	3
201CE4L04	Engineering Geology Lab	PCC	Lab	0	0	3	3	1.5
201CE4L05	Fluid Mechanics and Hydraulic Machinery	PCC	Lab	0	0	3	3	1.5
201SC4L13	**Skill Oriented Course-II** 3D Modeling using Revit	SC	Lab	0	0	4	4	2
201MC4T04	Essence of Indian Traditional Knowledge	MC	Theory	2	0	0	2	0
			TOTAL	**20**	**0**	**10**	**30**	**24**

BSC: Basic Sciences Courses; HSMC: Humanities and Social Sciences including Management Courses; ESC: Engineering Sciences Courses; PCC: Professional Core Courses; SC: Skill Oriented Course; PEC: Professional Elective Courses; OEC: Open Elective Courses; MC: Mandatory Courses; PROJ: Project.

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HONORS PROGRAM

Specialization: STRUCTURAL ENGINEERING

S.No.	Course Code	COURSE TITLE	L	T	P	C	SEMESTER
1.	201CE4H01	Advanced Concrete Technology	3	1	0	4	IV
2.	201CE5H05	Introduction to FEM	3	1	0	4	V
3.	201CE6H09	Sustainable materials and Green Buildings	3	1	0	4	VI
4.	201CE7H13	Structural Dynamics	3	1	0	4	VII

Specialization: TRANSPORTATION ENGINEERING

S.No.	Course Code	COURSE TITLE	L	T	P	C	SEMESTER
1.	201CE4H02	Pavement Materials	3	1	0	4	IV
2.	201CE5H06	Pavement analysis design	3	1	0	4	V
3.	201CE6H10	Intelligent transportation Systems	3	1	0	4	VI
4.	201CE7H14	Computer simulation methods in Traffic Engineering	3	1	0	4	VII

Specialization: GEOTECHNICAL ENGINEERING

S.No.	Course Code	COURSE TITLE	L	T	P	C	SEMESTER
1.	201CE4H03	Geology for Geotechnical Applications	3	1	0	4	IV
2.	201CE5H07	Geo Environmental Engineering	3	1	0	4	V
3.	201CE6H11	Geo synthetic and reinforced soil structures	3	1	0	4	VI
4.	201CE7H15	Dynamics of soils and foundations	3	1	0	4	VII

Specialization: RS AND GIS

S.No.	Course Code	COURSE TITLE	L	T	P	C	SEMESTER
1.	201CE4H04	Digital Cartography and GPS	3	1	0	4	IV
2.	201CE5H08	Urban Planning in GIS	3	1	0	4	V
3.	201CE6H12	Hydrological Modelling through RS&GIS	3	1	0	4	VI
4.	201CE7H16	Remote sensing in disaster Management	3	1	0	4	VII

MINOR PROGRAM

S.No.	Course Code	COURSE TITLE	L	T	P	C	SEMESTER
1.	201CE4M01	Engineering Mechanics	3	1	0	4	IV
2.	201CE4M02	Engineering Geology	3	1	0	4	IV
3.	201CE4M03	Surveying	3	1	0	4	IV
4.	201CE5M04	Building Materials & Construction	3	1	0	4	V
5.	201CE5M05	Fluid Mechanics	3	1	0	4	V
6.	201CE5M06	Strength of Materials	3	1	0	4	V
7.	201CE6M07	Soil Mechanics	3	1	0	4	VI

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8.	201CE6M08	Transportation Engineering	3	1	0	4	VI
9.	201CE6M09	Environmental Engineering	3	1	0	4	VI
10.	201CE7M10	Structural Analysis	3	1	0	4	VII
11.	201CE7M11	Water Resource Engineering	3	1	0	4	VII
12.	201CE7M12	Concrete Technology	3	1	0	4	VII

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V SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	Credits (C)
191CE5T09	Irrigation & water resource Engineering	PCC	2	0	0	2	2
191CE5T10	Engineering geology	PCC	2	0	0	2	2
191CE5T11	Design & drawing of Reinforced concrete structures	PCC	2	1	0	3	3
191CE5T12	Geotechnical engineering	PCC	3	0	0	3	3
----	Professional elective -I	PEC	3	0	0	3	3
----	Open elective -I	OEC	3	0	0	3	3
191CE5L05	Engineering geology lab	PCC	0	0	3	3	1.5
191CE5L06	Geotechnical engineering lab	PCC	0	0	3	3	1.5
191HS5T06	Employability Skills - III	HSMC	0	0	2	2	1
191PR5P02	Socially Relevant Project	PROJ	0	0	2	2	1
191MC5A07	Survey camp	MC	0	0	2	2	0
191MC5A08	Intellectual Property Rights and Patents	MC	2	0	0	2	0
		TOTAL	**15**	**1**	**12**	**28**	**21**

VI SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	Credits (C)
191CE6T13	Design & drawing of steel Structures	PCC	2	1	0	3	3
191CE6T14	Highway engineering	PCC	2	0	0	2	2
191CE6T15	Foundation engineering	PCC	2	0	0	2	2
----	Profession elective -II	PEC	3	0	0	3	3
----	Profession elective -III	PEC	3	0	0	3	3
----	Open elective -II	OEC	3	0	0	3	3
191CE6L07	Transportation engineering lab	PCC	0	0	3	3	1.5
191CE6L08	Computer aided design lab	PCC	0	0	3	3	1.5
191CE6L09	Irrigation design & drawing	PCC	0	0	3	3	1.5
191HS6T07	Employability skills - IV	HSMC	0	0	2	2	1
191MC6A09	Professional Ethics and Human Values	MC	2	0	0	2	0
		TOTAL	**15**	**1**	**11**	**27**	**21.5**

VII SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	Credits (C)
191CE7T16	Environmental Engineering	PCC	2	0	0	2	2
191CE7T17	Pre stressed concrete	PCC	3	0	0	3	3
191CE7T18	Estimation, specification& Contracts	PCC	3	0	0	3	3
----	Profession Elective - IV	PEC	3	0	0	3	3
----	Profession Elective - V	PEC	3	0	0	3	3
----	Open Elective - III	OEC	3	0	0	3	3
191CE7P03	Internship	PROJ	0	0	4	4	2
191CE7P03	Environmental Engineering Lab	PCC	0	0	3	3	1.5

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191CE7P04	Project Part -I	PROJ	0	0	4	4	2
		TOTAL	**17**	**0**	**11**	**28**	**22.5**

VIII SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
----	Profession Elective -VI	PEC	3	0	0	3	3
----	Open Elective -IV	OEC	3	0	0	3	3
191CE8P05	Project Part -II	PROJ	0	0	14	14	7
		TOTAL	**6**	**0**	**14**	**20**	**13**

BSC: Basic Sciences Courses; HSMC: Humanities and Social Sciences including Management Courses; ESC: Engineering Sciences Courses; PCC: Professional Core Courses; PEC: Professional Elective Courses; OEC: Open Elective Courses; SSC: Self Study Course; MC: Mandatory Courses; PROJ: Project.

S. No	Track title/sub specialization	Professional Elective-I	Professional Elective-II	Professional Elective-III	Professional Elective-IV	Professional Elective-V	Professional Elective-VI
1	**Structural engineering**	Construction Technology &Management 191CE5E02	Repair and Rehabilitation of Structures 191CE6E10	Finite Element Methods 191CE6E13	Design of Tall Buildings 191CE7E17	Advanced Structural Analysis 191CE7E21	Sustainable Materials and Green Buildings **191CE8E30**
2	**Geotechnical engineering**	Subsurface Investigation and Instrumentation 191CE5E04	Ground Improvement Techniques 191CE6E07	Expansive Soils 191CE6E12	Advanced Foundation Engineering 191CE7E16	Geo-techniques for Design of Underground Structures 191CE7E22	Geo-synthetics and Reinforced soil structures 191CE8E27
3	**Transportation engineering**	Airport Planning and Design 191CE5E01	Railway Engineering 191CE6E09	Docks and Harbour Engineering 191CE6E11	Traffic Engineering 191CE7E20	Traffic Analysis 191CE7E25	Infrastructure planning and Management **191CE8E28**
4	**Hydrology**	Urban Hydrology 191CE5E05	Hydropower Development 191CE6E08	Water Resources System Analysis 191CE6E15	Sustainable Water Resources Development 191CE7E19	River Basin Management 191CE7E24	Subsurface exploration importance and techniques involved 191CE8E29
5	**Environmental engineering**	Environmental Pollution and Control 191CE5E03	Air Pollution Engineering 191CE6E06	Industrial Waste & Waste-Water Engineering 191CE6E14	Environmental Impact Assessment 191CE7E18	Remote Sensing and GIS 191CE7E23	Environmental Remediation of Contaminated Sites 191CE8E26

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Open Elective - I (V Semester)

S. No	Course Code	Course Name	Not Offered to Branches	Offered By Department
1	191CE5O01	Basic Concrete Technology	CE, EEE	CE
2	191EE5O01	Electrical Safety	EEE	EEE
3	191EE5O02	Electrical Materials	EEE	EEE
4	191EE5O03	Basic Electrical Measurements	EEE, ECE	EEE
5	191EE5O03	Renewable Energy Sources	CE, EEE, ME, Ag. E	ME
6	191ME5O02	Fundamentals of Mechanical Engineering	ME	ME
7	191ME5O03	Supply Chain Management	ME	ME
8	191ME5O04	3D Printing	ME	ME
9	191ME5O05	Entrepreneurship Development and Incubation		ME
10	191EC5O01	Signals & Systems	EEE, ECE	ECE
11	191EC5O02	Digital Electronics and Logic Design	EEE, ECE, CSE, IT	ECE
12	191EC5O03	Semi conductor devices	EEE, ECE	ECE
13	191CS5O01	Data Structures	EEE, ECE, CSE, IT	CSE
14	191CS5O02	Object Oriented Programming through C++	CSE, IT	CSE
15	191CS5O03	Java Programming	CSE, IT	CSE
16	191CS5O04	R Programming		CSE
17	191IT5O01	Data Base Management Systems	CSE, IT	IT
18	191IT5O02	Computer Graphics	CSE, IT	IT
19	191MI5O01	Overview of Mining	Min.E	Min.E
20	191PT5O01	Process Intensification in Petroleum Industry	PT	PT
21	191PT5O02	Fundamentals of Petroleum Industry	PT	PT
22	191AG5O01	Basic Crop Production Practices	Ag.E	Ag.E

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Open Elective - II (VI Semester)

S. No	Course Code	Course Name	Not Offered to Branches	Offered By Department
1	191CE6O02	Disaster Management		CE
2	191EE6O04	Energy Audit and Conservation Management	EEE	EEE
3	191EE6O05	Non-Conventional Energy resources	EEE	EEE
4	191EE6O06	Instrumentation	EEE, ECE, Ag. E	EEE
5	191ME6O06	Solar Energy Utilisation	ME, Ag. E	ME
6	191ME6O07	Basic Thermodynamics and Heat Transfer	EEE, ME, PT, Ag.E, Min.E	ME
7	191ME6O08	Introduction to Hydraulics and Pneumatics	CE, ME, PT	ME
8	191ME6O09	3D Printing	ME	ME
9	191ME6O10	Robotics	ME	ME
10	191ME6O11	Management Science	CE, CSE, IT, PT, Min. E	ME
11	191ME6O12	Entrepreneurship Development and Incubation		ME
12	191EC6O04	Biomedical Instrumentation		ECE
13	191EC6O05	ECAD Tools	ECE	ECE
14	191CS6O05	Python Programming	EEE, CSE, IT	CSE
15	191CS6O06	Operating Systems	CSE, IT	CSE
16	191CS6O07	Web Technologies	CSE, IT	CSE
17	191CS6O08	Cyber Security	CSE, IT	CSE
18	191CS6O09	AR / VR		CSE
19	191IT6O03	Computer Organization	CSE, IT	IT
20	191IT6O04	AI Tools & Techniques	CSE, IT	IT
21	191IT6O05	Robotic Process Automation		IT
22	191MI6O02	Industrial Safety Practices	Ag.E	Min.E
23	191MI6O03	Electrical Equipment's in Mines		Min.E
24	191PT6O03	Unconventional Hydrocarbon Resources	PT	PT
25	191PT6O04	Asset Management		PT
26	191AG6O02	Weather forecast in Agriculture		Ag.E
27	191AG6O03	Bio-energy systems design and applications		Ag.E

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VII SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
171CE7T18	Geotechnical Engineering - II	PC	3	1	0	4	3
171CE7T19	Environmental Engineering	PC	3	1	0	4	3
171CE7T20	Remote Sensing and GIS Applications	PC	3	1	0	4	3
171CE7T21	Estimation, Specificationsand Contracts	PC	3	1	0	4	3
---	**Professional Elective – IV**	PE	3	1	0	4	3
---	**Professional Elective – V**	PE	3	1	0	4	3
171CE7L08	Environmental Engineering Lab	PC	0	0	3	3	2
171CE7L09	GIS And Computer Aided Design (CAD) Lab	PC	0	0	3	3	2
171CE7P01	Industry Oriented (Internship) Minor Project	PR	0	0	0	0	1
		TOTAL	**18**	**6**	**6**	**30**	**23**

VIII SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
---	**Professional Elective – VI**	PE	3	1	0	4	3
---	**Open Elective**	OE	3	1	0	4	3
171CE8P02	**Major Project**	PR	0	0	0	0	14
		TOTAL	**6**	**2**	**0**	**8**	**20**

Professional Elective – I (V Semester)

S.No	Course Code	Name of the Course
1	171CE5E01	Construction Technology and Management
2	171CE5E02	Urban Hydrology
3	171CE5E03	Traffic Engineering

Professional Elective – II (VI Semester)

S.No	Course Code	Name of the Course
1	171CE6E04	Ground Water Development
2	171CE6E05	Pavement Analysis and Design
3	171CE6E06	Repair and Rehabilitation of Structures

Professional Elective – III (VI Semester)

S.No	Course Code	Name of the Course
1	171CE6E07	Ground Improvement Techniques
2	171CE6E08	Finite Element Methods
3	171CE6E09	Earthquake Resistant Design

Professional Elective – IV (VII Semester)

S.No	Course Code	Name of the Course
1	171CE7E10	Advanced Structural Engineering
2	171CE7E11	Watershed Management
3	171CE7E12	Design of Tall Buildings

Professional Elective – V (VII Semester)

S.No	Course Code	Name of the Course
1	171CE7E13	Bridge Engineering
2	171CE7E14	Environmental Impact Assessment and Management
3	171CE7E15	Water Resources Systems Planning

Professional Elective – VI (VIII Semester)

S.No	Course Code	Name of the Course
1	171CE8E16	Urban Transportation Planning Engineering
2	171CE8E17	Soil Dynamics and Foundations
3	171CE8E18	Solid And Hazardous Waste Management
4	171CE8E19	Air Pollution and Control

Open Elective (VIII Semester)

S.No	CourseCode	Name of the Course
1	171CE8O01	Electronic Instrumentation
2	171CE8O02	Database Management Systems
3	171CE8O03	Alternative Energy Sources
4	171CE8O04	Waste Water Management
5	171CE8O05	Fundamentals of Liquefied Natural Gas
6	171CE8O06	Green Fuel Technologies
7	171CE8O07	Green Engineering Systems

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IRRIGATION & WATER RESOURCE ENGINEERING

V Semester
Course Code: 191CE5T09

L	T	P	C
2	0	0	2

Course Outcomes:
At the end of the Course, Student will be able to:

- CO 1: Explain the major hydrological components, various abstractions of precipitation and characteristics of runoff.
- CO 2: Analyze the different types of unit hydrographs, flood frequency studies and flood routing techniques.
- CO 3: Classify the various irrigation systems, sources of groundwater and diversion head works.
- CO 4: Illustrate the various design considerations of canal linings, canal structures canal regulation and cross drainage works.
- CO 5: Analyze the reservoir planning and design aspects of gravity dams, earthen dams, and spillways.

Mapping of course outcomes with program outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12
CO1	2	-	-	-	-	-	3	-	-	-	1	-
CO2	-	-	3	-	-	-	-	-	-	-	1	-
CO3	3	-	1	-	-	-	2	-	-	-	-	-
CO4	3	-	2	-	-	-	-	-	-	-	-	-
CO5	3	-	2	-	-	-	-	-	-	-	-	-

Mapping of course outcomes with program Specific Outcomes:

CO / PSO	PSO 1	PSO 2	PSO 3
CO1	2	-	-
CO2	2	-	-
CO3	3	-	-
CO4	2	-	-
CO5	2	-	-

UNIT-I:
Introduction:
Hydrologic cycle – Precipitation - measurement - rain gauge network - presentation of rainfall data - average rainfall - continuity and consistency of rainfall data - frequency of rainfall - Intensity-Duration-Frequency (IDF) curves - Depth-Area-Duration (DAD) curves.
Abstractions from precipitation:
Evaporation and Evapotranspiration- Factors affecting - measurement and control.
Infiltration- Factors affecting - measurement - and infiltration indices.
Runoff:
Catchment characteristics - factors affecting runoff - stream gauging - Rating curves - flow mass curve and flow duration curve.

UNIT-II:
Hydrograph analysis:
Components of hydrograph - separation of base flow - effective rainfall hyetograph and direct runoff hydrograph - unit hydrograph, -assumptions - derivation of unit hydrograph - unit hydrographs of different durations - principle of superposition and S-hydrograph methods - Instantaneous unit hydrograph - limitations and applications of unit hydrograph.

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Floods and Flood Routing:
Causes and effects - flood frequency analysis- Gumbel's and Log-Pearson type III distribution methods - Standard Project Flood (SPF) and Probable Maximum Flood (MPF) - flood control methods - Hydrologic routing- Muskingum and Modified Puls methods of routing.

UNIT-III:

Irrigation:
Types of irrigation systems - soil moisture constants - irrigation water requirements - consumptive use and its estimation - duty and delta - factors affecting - depth and frequency of irrigation

Groundwater:
Occurrence - types of aquifers - aquifer parameters - porosity - specific yield - permeability - transmissivity and storage coefficient

Diversion Head Works:
Types of diversion head works - weirs and barrages - layout of diversion head works - components. Bligh's creep theory - Khosla's theory - design of impervious floors for subsurface flow – exit gradient.

UNIT-IV:

Canals:
Classification, design of non-erodible canals - methods of economic section and maximum permissible velocity - design of erodible canals -Kennedy's silt theory and Lacey's regime theory

Canal Structures: Falls -Types and location

Canal Regulation and Cross Drainage works:
Head and cross regulators - design principles - Types and selection of cross drainage works - design principles of aqueduct - siphon aqueduct and superpassage - canal outlets-types - proportionality - sensitivity and flexibility.

UNIT-V:

Reservoir Planning and Dams:
Investigations - site selection for reservoir and dams - zones of storage.

Earth Dams:
Types, causes of failure - criteria for safe design - seepage - measures for control of seepage- filters - stability analysis-stability of downstream slope during steady seepage and upstream slope during sudden drawdown conditions.

Gravity dams and Spillways:
Forces acting on a gravity dam - causes of failure of a gravity dam - elementary and practical profile of a gravity dam - limiting height of a dam - stability analysis - Types of spillways - design principles of Ogee spillways - types of spillway crest gates - energy dissipation below spillways - stilling basin and its appurtenances - tail water rating curves.

Textbooks:

1. Engineering Hydrology, Subramanya.K, Tata McGraw-Hill Education Pvt. Ltd, New Delhi,2013
2. Irrigation andwaterpower Engineering, Dr.B.C. Punmia and Dr. Pande - B.B.Lal,Laxmi Publications Pvt. Ltd., New Delhi, 2006
3. Irrigation Engineering and Hydraulic structures, S.K. Garg; Khanna publishers New Delhi, 2006
4. Irrigation &Waterpower Engineering, B.C. Punmia, B.B.L. Pande, Ashok K.R. Jain, Arun.K.R. Jain, 16th Edition, LaxmiPublications (P) Ltd., New Delhi, 2009

Reference Books:

1. Water Resources Engineering, Mays L.W, Wiley India Pvt. Ltd, (2013.
2. Hydrology, Raghunath. H.M., New Age International Publishers, (2010.
3. Irrigation and Water Resources Engineering, G.L. Asawa, New Age International Publishers, 2005
4. Concrete dams, Varshney.R.S., 2nd Edition, Oxford andIBH Pub.Co.in, New Delhi, 1982.

Web Links:

1. http://nptel.ac.in/courses/105104103/
2. http://www.academicpub.org/jwrhe/
3. https://nptel.ac.in/downloads/105105110/
4. http://www.peo.on.ca/index.php/ci_id/21843/la_id/
5. https://engineering.tamu.edu/

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CONSTRUCTION TECHNOLOGY & MANAGEMENT

(Professional Elective-I)

V Semester

Course Code: 191CE5E02

L	T	P	C
3	0	0	3

Course Outcomes:

At the end of the Course, Student will be able to:

- CO 1: Apply the techniques of preliminary planning.
- CO 2: Solve the networks of project.
- CO 3: Apply the techniques of execution of works.
- CO 4: Apply the techniques of quality management.
- CO 5: Apply the techniques of quality control in construction.

Mapping of course outcomes with program outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	2	3	2	2	-	-	-	-	-	-	-	-
CO3	3	2	-	-	2	-	-	-	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

Mapping of course outcomes with program Specific Outcomes:

CO / PSO	PSO 1	PSO 2	PSO 3
CO1	2	-	-
CO2	3	-	-
CO3	2	-	-
CO4	2	-	-
CO5	2	-	-

UNIT-I:

Preliminary Planning Organisational Aspects:

Importance of Construction Sector , Definition of Construction Management ,Need for Construction Management Factors Involved in Construction or , Objectives of Construction Management Importance of Planning Aspects to be Considered During Preliminary Planning of Different Projects ,Feasibility Report , Site Investigation ,Project Report , Organisation , Different Engineering Departments of the Government , Organisational Structure of Engineering Department ,Duties of Different Officers ,Administrative Approval ,Technical Sanction , Budget Provision.

UNIT-II:

Construction Planning, Contract and Tenders

construction planning, construction stage, Construction Operations, Scheduling, Types of Scheduling, Methods of Scheduling ,Scheduling of Network Analysis, CPM and PERT ,Difference Between PERT" AND "CPM" ,Terminology in CPM ,Conventions Followed ,Steps in Critical Path, Advantages of CPM Network in Execution of a Project , Problems on CPM , Caused of Accidents in Construction Industry , Effects of Accidents ,Safety Measures at the Construction site

Contract& Tenders: Definition, legal obligation of contract, contract document, types of contracts, Necessity of Tenders , Differences Between Tender and Agreements , Tender Notice , Draft Tender Notice , Tender

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Documents ,Short TenderNotice ,Earnest Money Deposit and Security Deposit , Opening of Tenders ,Scrutiny of Tenders , Comparative Statement ,Acceptance of Tender , Work Order ,Contract Agreement.

UNIT-III:

Execution of work, payment of bills and stores:

Introduction, regular establishment, work charged establishment, duties of super visor/junior engineer/assistant execution engineer, need for inspection of works by DEE and E. E, duties of the deputy executive engineer, duties of executive engineer, need of super vision, Principles or supervision ,Necessity for Sampling and Testing , Departmental Execution of Work , Nominal Muster Roll (N.M.R): N M.R Format, Rules Regarding Preparation of Muster Roll , Common Irregularities in Muster Rolls, Imprest ,Measurement Book-M' BOOK ,Rules to be Followed in Recording Measurements ,Pre-Measurement , Check Measurement , Contractor's Acceptance of Measurements , Preparation of Bills , Types of Bills ,Mode of Payment ,Checking of Bills , Recoveries to be Made from Bills , Stores , Classification of Stores , General Stock Items ,Materials Charged to Works ,Plant and Machinery , Small Tools and Plants ,Storage of Stock. Record Keeping in Stores , ,Receipts, Issues , Indents ,Invoice , Bin Card Unstamped Receipt (U.S.R) ,Transfer Entry Order ,Materials at Site Account , Issue Rate ,Stock Register , Verification of Stores ,Accounting of Surpluses, Accounting of Shortages ,Survey Report and Write Off , Central Stores

UNIT-IV:

TQM and quality management

ISO, CONCEPT OF QUALITY, quality and sales, quality system, elements ofquality system, contract review(CLAUSE 4.3), design control IS 9001(CLAUSE 4.4),Document Control (Clause 4.5) ,Purchasing (Clause 4.6) ,Purchaser Supplied Product (Clause 4.7) , Product Identification and Traceability: ISO 9001 (4.8) ,Process Control (Clause 4.9) ISO 9001: 1994, Inspection and Testing ,Quality Assurance ,Indian Standards on Quality Systems ,Evolution of ISO 9000, ISO 9000 Certification-Importance , Outstanding Features of ISO 9000 Series of Standards , Limitations or Drawbacks of ISO 9000 ,Total Quality management (T.O.M), Need for TOMI , Steps Involved in TOM , Benefits of TOM , ISO-9000 and TOM

UNIT-V:

Quality control in Construction and tolerance levels

Introduction, quality control, elements of quality, quality control methods,

Control Aspects of Batching and Mixing, Mixing of Concrete ,Inspection of Reinforcement Grills , Inspection and Examination of Formwork, Relationship Between the Strength of Brick Work and Strength of Mortar ,Quality of the Filler Materials ,Construction Tolerance ,Tolerances Levels in Construction Industry , Dimenstional Accuracies ,Visual Appearance.

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Text Books:

1. Construction planning, Equipment and method, purifoy and schlender, shapira, Tata McGraw-Hill, 2010.
2. Construction project management Theory and Practice, Kumar Neerah Jha, Pearson, 2011.
3. Construction Technology, Subir K, Sarkar and subhajit Saraswati, Oxford University press, 2008.

Reference Books:

1. Construction Project Management, K.K.Chitkara, McGraw Hill, 2014.
2. Project planning and control with PERT and CPM, Dr.B.C.Punmia, K.K.Khandelwal, Laxmi publication, 2016.

Web Links:

1. nptel.ac.in/courses/105103093/
2. nptel.ac.in/courses/105103093/22

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Department of Civil Engineering

Syllabus revision Index for the Academic Year 2021-2022 B.Tech Civil Engineering

S.No	Name of the course	Percentage of syllabus change
1.	Irrigation & water resource Engineering	33.2
2.	PE I Construction Technology &Management	50

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Water Resource Engineering - I	Irrigation & water resource Engineering
Course Code	171CE5T13	191CE5T09
Syllabus	UNIT –I Introduction: Engineering hydrology and its applications - Hydrologic cycle - Hydrological data-sources of data. Precipitation: Types and forms - measurement - rain gauge network - presentation of rainfall data- average rainfall - continuity and consistency of rainfall data - frequency of rainfall - IntensityDuration-Frequency (IDF) curves - Depth-Area-Duration (DAD) curves - Probable Maximum Precipitation (PMP) - design storm.	UNIT-I: Introduction: Hydrologic cycle – Precipitation - measurement - rain gauge network - presentation of rainfall data - average rainfall - continuity and consistency of rainfall data - frequency of rainfall - Intensity-Duration-Frequency (IDF) curves - Depth-AreaDuration (DAD) curves. Abstractions from precipitation: Evaporation and Evapotranspiration- Factors affecting - measurement and control. Infiltration-Factors affecting - measurement - and infiltration indices. Runoff: Catchment characteristics - factors affecting runoff - stream gauging - Rating curves - flow mass curve and flow duration curve
	UNIT – II Abstractions from precipitation: Initial abstractions - Evaporation- Factors affecting - measurement and reduction. Evapo-transpiration- Factors affecting - measurement and control. Infiltration-Factors affecting - Infiltration capacity curve - measurement - and infiltration indices.	UNIT-II: Hydrograph analysis: Components of hydrograph - separation of base flow - effective rainfall hyetograph and direct runoff hydrograph - unit hydrograph,-assumptions - derivation of unit hydrograph - unit hydrographs of different durations - principle of superposition and S-hydrograph methods - Instantaneous unit hydrograph - limitations and applications of unit hydrograph. Floods and Flood Routing: Causes and effects - flood frequency analysis- Gumbel's and Log-Pearson type III distribution methods - Standard Project Flood (SPF) and Probable Maximum Flood (MPF) - flood control methods - Hydrologic routing - Muskingum and Modified Puls methods of routing.
	UNIT–III Runoff: Catchment characteristics - factors affecting runoff - components - computation-empirical formulae - tables and curves - stream gauging - Rating curves -	UNIT-III: Irrigation: Types of irrigation systems - soil moisture constants - irrigation water requirements - consumptive use and its estimation - duty and delta - factors affecting - depth and frequency of irrigation Groundwater: Occurrence

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	flow mass curve and flow duration curve - rainfall-runoff modeling. Hydrograph analysis: Components of hydrograph - separation of base flow - effective rainfall hyetograph and direct runoff hydrograph - unit hydrograph,-assumptions - derivation of unit hydrograph - unit hydrographs of different durations - principle of superposition and S-hydrograph methods - Instantaneous unit hydrograph - limitations and applications of unit hydrograph.	- types of aquifers - aquifer parameters - porosity - specific yield - permeability - transmissivity and storage coefficient Diversion Head Works: Types of diversion head works - weirs and barrages - layout of diversion head works - components. Bligh's creep theory - Khosla's theory - design of impervious floors for subsurface flow – exit gradient.
	UNIT – IV Floods: Causes and effects - flood frequency analysis- Gumbel's and Log-Pearson type III distribution methods - Standard Project Flood (SPF) and Probable Maximum Flood (MPF) - flood control methods and management. Flood Routing: Hydrologic routing - channel and reservoir routing - Muskingum and Modified Puls methods of routing	UNIT-IV: Canals: Classification, design of non-erodible canals - methods of economic section and maximum permissible velocity - design of erodible canals -Kennedy's silt theory and Lacey's regime theory Canal Structures: Falls - Types and location Canal Regulation and Cross Drainage works: Head and cross regulators - design principles - Types and selection of cross drainage works - design principles of aqueduct - siphon aqueduct and super passage - canal outlets-types - proportionality - sensitivity and flexibility.
	UNIT – V Groundwater: Occurrence - types of aquifers - aquifer parameters - porosity - specific yield - permeability - transmissivity and storage coefficient - types of wells - Darcy's law - Dupuit's equationsteady radial flow to wells in confined and unconfined aquifers - yield of a open wellrecuperation test	UNIT-V: Reservoir Planning and Dams: Investigations - site selection for reservoir and dams - zones of storage. Earth Dams: Types, causes of failure - criteria for safe design - seepage - measures for control of seepage-filters - stability analysis-stability of downstream slope during steady seepage and upstream slope during sudden drawdown conditions. Gravity dams and Spillways: Forces acting on a gravity dam - causes of failure of a gravity dam - elementary and practical profile of a gravity dam - limiting height of a dam - stability analysis - Types of spillways - design principles of Ogee spillways - types of spillway crest gates - energy dissipation below spillways - stilling basin and its appurtenances - tail water rating curves

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	**Pre-Revision**	**Post-Revision**
Course Title	(PE I)Construction Technology and . Management	PE I Construction Technology &Management
Course Code	171CE5E01	191CE5E02
	UNIT –I: Introduction: Steps involved in planning - Objectives – Principles – Advantages - Limitations - Stages of planning - Scheduling - Preparation of construction schedules -Methods of scheduling - Bar charts -Mile stone charts – Controlling - Project work break down.	UNIT-I: Preliminary Planning Organisational Aspects: Importance of Construction Sector , Definition of Construction Management ,Need for Construction Management Factors Involved in Construction or , Objectives of Construction Management Importance of Planning Aspects to be Considered During Preliminary Planning of Different Projects ,Feasibility Report , Site Investigation ,Project Report , Organisation , Different Engineering Departments of the Government , Organisational Structure of Engineering Department ,Duties of Different Officers ,Administrative Approval ,Technical Sanction , Budget Provision.
Syllabus	UNIT – II: Project Management Through Networks: Objectives of network techniques - Fundamentals of network analysis - Events; Activities-Dummies - Types of networks - Choice of network type - Advantages of network techniques over conventional techniques. Program Evaluation and Review Technique (PERT): Introduction - Earliest expected time - Latest allowable occurrence time - Slack - Critical path - Probability of completion time for a project.	UNIT-II: Construction Planning, Contract and Tenders construction planning, construction stage, Construction Operations, Scheduling, Types of Scheduling , Methods of Scheduling ,Scheduling of Network Analysis, CPM and PERT ,Difference Between PERT" AND "CPM" ,Terminology in CPM ,Conventions Followed ,Steps in Critical Path, Advantages of CPM Network in Execution of a Project ,Problems on CPM , Caused of Accidents in Construction Industry ,Effects of

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		Accidents ,Safety Measures at the Construction site Contract& Tenders: Definition, legal obligation of contract, contract document, types of contracts, Necessity of Tenders , Differences Between Tender and Agreements , Tender Notice , Draft Tender Notice , Tender Documents ,Short Tender Notice ,Earnest Money Deposit and Security Deposit , Opening of Tenders ,Scrutiny of Tenders , Comparative Statement ,Acceptance of Tender , Work Order ,Contract Agreement.
	UNIT – III: Critical Path Method (CPM): Introduction-Difference between CPM and PERT-Time estimates- Earliest event time- Latest event time- Float- Critical activities and critical path. Cost Control: Direct cost-indirect cost-total project cost- Optimization of cost through networks-Steps involved In optimization of cost- allocation of resources	UNIT-III: Execution of work, payment of bills and stores: Introduction, regular establishment, work charged establishment, duties of super visor/junior engineer/assistant execution engineer, need for inspection of works by DEE and E. E, duties of the deputy executive engineer, duties of executive engineer, need of super vision, Principles or supervision ,Necessity for Sampling and Testing , Departmental Execution of Work , Nominal Muster Roll (N.M.R): N M.R Format, Rules Regarding Preparation of Muster Roll , Common Irregularities in Muster Rolls, Imprest ,Measurement Book-M' BOOK ,Rules to be Followed in Recording Measurements ,Pre-Measurement , Check Measurement , Contractor's Acceptance of Measurements , Preparation of Bills , Types of Bills ,Mode of Payment ,Checking of Bills , Recoveries to be Made from Bills , Stores , Classification of Stores , General Stock Items ,Materials Charged to Works ,Plant and Machinery , Small Tools and Plants ,Storage of Stock. Record Keeping in Stores , ,Receipts, Issues , Indents ,Invoice , Bin Card Unstamped Receipt (U.S.R) ,Transfer Entry Order ,Materials at Site Account , Issue Rate ,Stock Register , Verification of Stores ,Accounting of Surpluses,

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		Accounting of Shortages ,Survey Report and Write Off , Central Stores
	UNIT – IV: Construction Equipment: Classification of construction equipment- Earth moving equipmentcapacities of trucks and handling equipment-calculation of truck production- Excavation equipment-Hauling equipment- Earth compaction equipment- Hoisting equipment.	UNIT-IV: TQM and quality management ISO, CONCEPT OF QUALITY, quality and sales, quality system, elements of quality system, contract review(CLAUSE 4.3), design control IS 9001(CLAUSE 4.4),Document Control (Clause 4.5) ,Purchasing (Clause 4.6) ,Purchaser Supplied Product (Clause 4.7) , Product Identification and Traceability: ISO 9001 (4.8) , Process Control (Clause 4.9) ISO 9001: 1994, Inspection and Testing ,Quality Assurance ,Indian Standards on Quality Systems ,Evolution of ISO 9000, ISO 9000 Certification- Importance , Outstanding Features of ISO 9000 Series of Standards , Limitations or Drawbacks of ISO 9000 ,Total Quality management (T.O.M), Need for TOMI , Steps Involved in TOM , Benefits of TOM , ISO-9000 and TOM
	UNIT – V: Aggregate & Concreting Equipment: Crushers & Types of crushers-selection of crushing equipment- concrete mixers- mixing and placing of concrete- consolidating and finishingPiling & Pile driving equipment - form work- fabrication and erection	UNIT-V: Quality control in Construction and tolerance levels Introduction, quality control, elements of quality, quality control methods, Control Aspects of Batching and Mixing, Mixing of Concrete ,Inspection of Reinforcement Grills , Inspection and Examination of Formwork, Relationship Between the Strength of Brick Work and Strength of Mortar ,Quality of the Filler Materials ,Construction Tolerance ,Tolerances Levels in Construction Industry , Dimensional Accuracies ,Visual Appearance.

Signature of the course coordinator

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Program Name : B.Tech. in Electrical and Electronics Engineering

Syllabus Revision for the Academic Year 2021-2022				
S.No	**Semester**	**Course Code**	**Course Name**	**% of content revised for the existing year**
1	I	201HS1T01	Communicative English	0
2	I	201BS1T01	Differential equations and Linear algebra	0
3	I	201BS1T03	Applied Physics	0
4	I	201ES1T02	Programming for Problem Solving using C	0
5	I	201ES1I01	Engineering Graphics and Design	0
6	I	201HS1L01	Communicative English Lab	0
7	I	201BS1L02	Applied Physics Lab	0
8	I	201ES1L02	Programming for Problem Solving using C Lab	0
9	I	201MC1T01	Environmental Science	0
10	II	201BS2T05	Partial Differential Equations and Vector Calculus	0
11	II	201BS2T06	Transform Techniques	0
12	II	201ES2T07	Data Structures through C	0
13	II	201ES2T09	Basic Electrical Circuits	0
14	II	201ES2T13	Basic Civil and Mechanical Engineering	0
15	II	201ES2L06	Data Structures through C Lab	0
16	II	201ES2L09	Electrical Engineering Workshop	0
17	II	201ES2L11	Basic Civil and Mechanical Engineering Lab	0
18	II	201MC2L01	Professional Communications Skills Lab	0

19	II	201MC2T02	Constitution of India	0
20	III	201BS3T11	Numerical methods & Complex variables	0
21	III	201EE3T01	Analog Electronic Circuits	30
22	III	201EE3T02	Electrical Circuit Analysis	0
23	III	201EE3T03	DC Machines and transformers	20
24	III	201EE3T04	Electromagnetic Fields	0
25	III	201EE3L01	DC machines and transformers Lab	20
26	III	201EE3L02	Electrical Circuits Lab	10
27	III	201EE3L03	Analog Electronic Circuits Lab	0
28	III	201SO3L02	Design of Electrical Circuits using Engineering Software	100
29	III	201MC3T03	Biology For Engineers	0
30	IV	201EE4T05	Electrical Power Generation and Distribution Systems	0
31	IV	201EE4T06	Digital Electronics	5
32	IV	201EE4T07	Induction and Synchronous Machines	5
33	IV	201HS4T03	Managerial Economics and Financial Analysis	0
34	IV	201ES4T18	Python Programming	0
35	IV	201ES4L15	Python Programming Lab	0
36	IV	201EE4L04	Induction and Synchronous Machines Lab	0
37	IV	201EE4L05	Digital Electronics lab	0
38	IV	201SC4L14	IoT Applications of Electrical Engineering	100
39	IV	201MC4T04	Essence of Indian Traditional Knowledge	0
40	V	191EE5T10	Power Systems –II	0

41	V	191EE5T11	Power Electronics	5
42	V	191EE5T12	Electrical Measurements and Instrumentation	100
43	V	191HS5T05	Managerial Economics andFinancial Analysis	0
44	V	191EE5E03	Renewable energy systems	15
45	V	191EE5E02	Electrical Machine Modeling and Analysis	0
46	V	191EE5E01	Advanced Control Systems	0
47	V	191EE5E03	Renewable energy systems	15
48	V	191ME5O02	Fundamentals of Mechanical Engineering	0
49	V	191ME5O03	Supply Chain Management	100
50	V	191ME5O04	3D Printing	100
51	V	191ME5O05	Entrepreneurship Development and Incubation	100
52	V	191CS5O02	Object Oriented Programming through C++	100
53	V	191CS5O03	Java Programming	100
54	V	191CS5O04	R Programming	100
55	V	191IT5O01	Data Base Management Systems	100
56	V	191IT5O02	Computer Graphics	100
57	V	191MI5O01	Overview of Mining	100
58	V	191PT5O01	Process Intensification in Petroleum Industry	100
59	V	191PT5O02	Fundamentals of Petroleum Industry	100
60	V	191AG5O01	Basic Crop Production Practices	100
61	V	191EE5L04	Electrical Machines-II Lab	5
62	V	191EE5L05	Control Systems Lab	0
63	V	191HS5T06	Employability Skills -III	0

64	V	191PR5P02	Socially Relevant Project	100
65	V	191MC5A08	Intellectual Property Rights and Patents	0
66	VI	191EE6T13	Microprocessor & Interfacing	35
67	VI	191EE6T14	Power System Analysis	0
68	VI	191EE6T15	Power Converter Drives	5
69	VI	191EE6E07	Electrical Distribution Systems	5
70	VI	191EE6E05	Advanced Power Electronics Converters	100
71	VI	191EE6E06	Digital Control Systems	0
72	VI	191EE6E08	Energy Audit, Conservation & Management	0
73	VI	191EE6E11	High Voltage Transmission	100
74	VI	191EE6E12	Switched mode power Converters	100
75	VI	191EE6E09	Control Systems Design	100
76	VI	191EE6E10	Electrical Safety	100
77	VI	191CE6O02	Disaster Management	100
78	VI	191ME6O06	Solar Energy Utilisation	100
79	VI	191ME6O08	Introduction to Hydraulics and Pneumatics	100
80	VI	191ME6O09	3D Printing	100
81	VI	191ME6O10	Robotics	100
82	VI	191ME6O11	Management Science	100
83	VI	191ME6O12	Entrepreneurship Development and Incubation	100
84	VI	191EC6O04	Biomedical Instrumentation	100
85	VI	191EC6O05	ECAD Tools	100
86	VI	191CS6O06	Operating Systems	100
87	VI	191CS6O07	Web Technologies	100
88	VI	191CS6O08	Cyber Security	100

89	VI	191CS6O09	AR / VR	100
90	VI	191IT6O03	Computer Organization	100
91	VI	191IT6O04	AI Tools & Techniques	100
92	VI	191IT6O05	Robotic Process Automation	100
93	VI	191MI6O02	Industrial Safety Practices	100
94	VI	191MI6O03	Electrical Equipment's in Mines	100
95	VI	191PT6O03	Unconventional Hydrocarbon Resources	100
96	VI	191PT6O04	Asset Management	100
97	VI	191AG6O02	Weather forecast in Agriculture	100
98	VI	191AG6O03	Bio-energy systems design and applications	100
99	VI	191EE6L06	Electrical Measurements & Instrumentation Lab	100
100	VI	191EE6L07	Power Electronics Lab	0
101	VI	191HS6T07	Employability Skills -IV	0
102	VI	191MC6A09	Professional Ethics and Human Values	100
103	VII	171EE7T18	Utilization of Electrical Energy	0
104	VII	171EE7T19	Linear and Digital IC Applications	0
105	VII	171EE7T20	Power System Operation and Control	0
106	VII	171EE7T21	Switch Gear and Protection	0
107	VII	171EE7E11	Optimization Techniques	0
108	VII	171EE7E12	Digital Signal Processing	0
109	VII	171EE7E13	Special Electrical Machines	0

110	VII	171EE7E14	High Voltage Engineering	0
111	VII	171EE7E15	Electric Power Quality	0
112	VII	171EE7E16	EHVAC Transmission	0
113	VII	171EE7L09	Power Systems Simulation Lab	0
114	VII	171EE7L10	Micro Processor and Micro Controllers Lab	0
115	VII	171EE7P01	Industry Oriented (Internship) Minor Project	0
116	VIII	171EE8E17	HVDC Transmission	0
117	VIII	171EE8E18	Flexible AC Transmission Systems	0
118	VIII	171EE8E19	Power System Reforms	0
119	VIII	171EE8E20	Digital Control Systems	0
120	VIII	171EE8O01	Energy Audit, Conservation and Management	0
121	VIII	171EE8O02	VLSI Design	0
122	VIII	171EE8O03	Unix and Shell Programming	0
123	VIII	171EE8O04	Neural Networks And Fuzzy Logic	0
124	VIII	171EE8O05	Robotics	0
125	VIII	171EE8O06	Vehicular Electric Power Systems	0
126	VIII	171EE8O07	Internet of Things	0
127	VIII	171EE8O08	Cyber Security	0
128	VIII	171EE8P02	Major Project	0
Total number of courses in the academic year 2021-2022				= 128
Number of courses having revision in syllabus content >/= 20% in the academic year 2021-2022				= 49
Percentage of syllabus revision carried out in the academic year 2021-22 = (49/128)*100				= 38.28%

Program Coordinator

Head of the Department

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PROGRAM STRUCTURE

I SEMESTER

Course Code	Course Title	Course Title	Course Type	Total Number of Contact Hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201HS1T01	Communicative English	HSC	Theory	3	0	0	3	3
201BS1T01	Differential equations and Linear algebra	BSC	Theory	3	0	0	3	3
201BS1T03	Applied Physics	BSC	Theory	3	0	0	3	3
201ES1T02	Programming forProblem Solving using C	ESC	Theory	3	0	0	3	3
201ES1I01	Engineering Graphics and Design	ESC	Integrated	2	0	2	4	3
201HS1L01	Communicative English Lab	HSC	Lab	0	0	3	3	1.5
201BS1L02	Applied Physics Lab	BSC	Lab	0	0	3	3	1.5
201ES1L02	Programming for Problem Solving using C Lab	ESC	Lab	0	0	3	3	1.5
201MC1T01	Environmental Science	MC	Theory	2	0	0	2	0
			TOTAL	**16**	**0**	**11**	**27**	**19.5**

II SEMESTER

Course Code	Course Title	Course Title	Course Type	Total Number of Contact Hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS2T05	Partial Differential Equations and Vector Calculus	BSC	Theory	3	0	0	3	3
201BS2T06	Transform Techniques	BSC	Theory	3	0	0	3	3
201ES2T07	Data Structures through C	ESC	Theory	3	0	0	3	3
201ES2T09	Basic Electrical Circuits	ESC	Theory	3	0	0	3	3
201ES2T13	Basic Civil and Mechanical Engineering	ESC	Theory	3	0	0	3	3
201ES2L06	Data Structures through C Lab	ESC	Lab	0	0	3	3	1.5
201ES2L09	Electrical Engineering Workshop	ESC	Lab	0	0	3	3	1.5
201ES2L11	Basic Civil and Mechanical Engineering Lab	ESC	Lab	0	0	3	3	1.5
201MC2L01	Professional Communications Skills Lab	MC	Lab	0	0	3	3	0
201MC2T02	Constitution of India	MC	Theory	2	0	0	2	0
			TOTAL	**17**	**0**	**12**	**29**	**19.5**

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III SEMESTER

Course Code	Course Title	Course Title	Course Type	Total Number of Contact Hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS3T11	Numerical methods & Complex Variables	BSC	Theory	3	0	0	3	3
201EE3T01	Analog Electronic Circuits	PCC	Theory	3	0	0	3	3
201EE3T02	Electrical Circuit Analysis	PCC	Theory	3	0	0	3	3
201EE3T03	DC Machines and transformers	PCC	Theory	3	0	0	3	3
201EE3T04	Electromagnetic Fields	PCC	Theory	3	0	0	3	3
201EE3L01	DC machines and transformers Lab	PCC	Lab	0	0	3	3	1.5
201EE3L02	Electrical Circuits Lab	PCC	Lab	0	0	3	3	1.5
201EE3L03	Analog Electronic Circuits Lab	PCC	Lab	0	0	3	3	1.5
201SC3L02	Design of Electrical Circuits using Engineering Software Tools	SC	Lab	0	0	4	4	2
201MC3T03	Biology For Engineers	MC	Theory	2	0	0	0	0
			Total	18		0	13	21.5

IV SEMESTER

Course Code	Course Title	Course Title	Course Type	Total Number of Contact Hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201EE4T05	Electrical Power Generation and Distribution Systems	PCC	Theory	3	0	0	3	3
201EE4T06	Digital Electronics	PCC	Theory	3	0	0	3	3
201EE4T07	Induction and Synchronous Machines	PCC	Theory	3	0	0	3	3
201HS4T03	Managerial Economics and Financial Analysis	HSC	Theory	3	0	0	3	3
201ES4T18	Python Programming	ESC	Theory	3	0	0	3	3
201ES4L15	Python Programming Lab	ESC	Lab	0	0	3	3	1.5
201EE4L04	Induction and Synchronous Machines Lab	PCC	Lab	0	0	3	3	1.5
201EE4L05	Digital Electronics lab	PCC	Lab	0	0	3	3	1.5
201SC4L14	IoT Applications of Electrical Engineering	SC	Lab	0	0	4	4	2
201MC4T04	Essence of Indian Traditional Knowledge	MC	Theory	2	0	0	0	0
			TOTAL	18	0	13	27	21.5
	Internship 2 months (Mandatory) during summer vacation							
Honor/Minor course (the hours distribution can be 3-0-2 or 3-1-0 also)				4	0	0	4	4

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V SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
191EE5T10	Power Systems –II	PCC	3	0	0	3	3
191EE5T11	Power Electronics	PCC	3	0	0	3	3
191EE5T12	Electrical Measurements and Instrumentation	PCC	3	0	0	3	3
191HS5T05	Managerial Economics and Financial Analysis	HSC	3	0	0	3	3
----	Professional Elective-I	PEC	3	0	0	3	3
----	Open Elective-I	OEC	3	0	0	3	3
191EE5L04	Electrical Machines-II Lab	PCC	0	0	3	3	1.5
191EE5L05	Control Systems Lab	PCC	0	0	3	3	1.5
191HS5T06	Employability Skills -III	HSMC	0	0	2	2	1
191PR5P02	Socially Relevant Project	PROJ	0	0	2	2	1
191MC5A08	Intellectual Property Rights and Patents	MC	2	0	0	2	0
		TOTAL	**18**	**0**	**10**	**28**	**23**

VI SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
191EE6T13	Microprocessor & Interfacing	PCC	3	0	0	3	3
191EE6T14	Power System Analysis	PCC	3	0	0	3	3
191EE6T15	Power Converter Drives	PCC	3	0	0	3	3
----	Professional Elective -II	PEC	3	0	0	3	3
----	Professional Elective -III	PEC	3	0	0	3	3
----	Open Elective -II	OEC	3	0	0	3	3
191EE6L06	Electrical Measurements & Instrumentation Lab	PCC	0	0	3	3	1.5
191EE6L07	Power Electronics Lab	PCC	0	0	3	3	1.5
191HS6T07	Employability Skills -IV	HSMC	0	0	2	2	1
191MC6A09	Professional Ethics and Human Values	MC	2	0	0	2	0
		TOTAL	**18**	**0**	**8**	**26**	**22**

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Electrical & Electronics Engineering—Tracks and Courses

Tracks	Professional Elective-I	Professional Elective-II	Professional Elective-III	Professional Elective-IV	Professional Elective-V	Professional Elective-VI
Power Systems	Renewable energy systems 191EE5E03	Electrical Distribution Systems 191EE6E07	High Voltage Transmission 191EE6E11	Smart Micro Grid 191EE7E15	Power Quality & FACTS 191EE7E18	Machine Learning for Engineering and Science Applications 191EE8E20
Power Electronics	Electrical Machine Modeling and Analysis 191EE5E02	Advanced Power Electronics Converters 191EE6E05	Switched mode power Converters 191EE6E12	Electrical and Hybrid Vehicles 191EE7E13	Power Quality & FACTS 191EE7E18	Digital Signal Processing 191EE8E19
Control Systems	Advanced Control Systems 191EE5E01	Digital Control Systems 191EE6E06	Control Systems Design 191EE6E09	Smart Micro Grid 191EE7E15	Microcontroller and Applications 191EE7E17	Neural Networks for Signal Processing 191EE8E04
Energy Systems & Instrumentation	Renewable energy systems 191EE5E03	Energy Audit, Conservation & Management 191EE6E08	Electrical Safety 191EE6E10	PLC & Applications 191EE7E14	Energy storage systems 191EE7E16	Machine Learning for Engineering and Science Applications 191EE8E20

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Open Elective - I (V Semester)

S. No	Course Code	Course Name	Not Offered to Branches	Offered By Department
1	191CE5O01	Basic Concrete Technology	CE, EEE	CE
2	191EE5O01	Electrical Safety	EEE	EEE
3	191EE5O02	Electrical Materials	EEE	EEE
4	191EE5O03	Basic Electrical Measurements	EEE, ECE	EEE
5	191ME5O01	Renewable Energy Sources	CE, EEE, ME, Ag. E	ME
6	191ME5O02	Fundamentals of Mechanical Engineering	ME	ME
7	191ME5O03	Supply Chain Management	ME	ME
8	191ME5O04	3D Printing	ME	ME
9	191ME5O05	Entrepreneurship Development and Incubation		ME
10	191EC5O01	Signals & Systems	EEE, ECE ·	ECE
11	191EC5O02	Digital Electronics and Logic Design	EEE, ECE, CSE, IT	ECE
12	191EC5O03	Semi-Conductor Devices	EEE, ECE	ECE
13	191CS5O01	Data Structures	EEE, ECE, CSE, IT	CSE
14	191CS5O02	Object Oriented Programming through C++	CSE, IT	CSE
15	191CS5O03	Java Programming	CSE, IT	CSE
16	191CS5O04	R Programming		CSE
17	191IT5O01	Data Base Management Systems	CSE, IT	IT
18	191IT5O02	Computer Graphics	CSE, IT	IT
19	191MI5O01	Overview of Mining	Min.E	Min.E
20	191PT5O01	Process Intensification in Petroleum Industry	PT	PT
21	191PT5O02	Fundamentals of Petroleum Industry	PT	PT
22	191AG5O01	Basic Crop Production Practices	Ag.E	Ag.E

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Open Elective - II (VI Semester)

S. No	Course Code	Course Name	Not Offered to Branches	Offered By Department
1	191CE6O02	Disaster Management		CE
2	191EE6O04	Energy Audit and Conservation Management	EEE	EEE
3	191EE6O05	Non Conventional Energy resources	EEE	EEE
4	191EE6O06	Instrumentation	EEE, ECE, Ag. E	EEE
5	191ME6O06	Solar Energy Utilisation	ME, Ag. E	ME
6	191ME6O07	Basic Thermodynamics and Heat Transfer	EEE, ME, PT, Ag.E, Min.E	ME
7	191ME6O08	Introduction to Hydraulics and Pneumatics	CE, ME, PT	ME
8	191ME6O09	3D Printing	ME	ME
9	191ME6O10	Robotics	ME	ME
10	191ME6O11	Management Science	CE, CSE, IT, PT, Min. E	ME
11	191ME6O12	Entrepreneurship Development and Incubation		ME
12	191EC6O04	Biomedical Instrumentation		ECE
13	191EC6O05	ECAD Tools	ECE	ECE
14	191CS6O05	Python Programming	EEE, CSE, IT	CSE
15	191CS6O06	Operating Systems	CSE, IT	CSE
16	191CS6O07	Web Technologies	CSE, IT	CSE
17	191CS6O08	Cyber Security	CSE, IT	CSE
18	191CS6O09	AR / VR		CSE
19	191IT6O03	Computer Organization	CSE, IT	IT
20	191IT6O04	AI Tools & Techniques	CSE, IT	IT
21	191IT6O05	Robotic Process Automation	Ag.E	IT
22	191MI6O02	Industrial Safety Practices		Min.E
23	191MI6O03	Electrical Equipment's in Mines		Min.E
24	191PT6O03	Unconventional Hydrocarbon Resources	PT	PT
25	191PT6O04	Asset Management		PT
26	191AG6O02	Weather forecast in Agriculture		Ag.E
27	191AG6O03	Bio-energy systems design and applications		Ag.E

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VII SEMESTER

Course Code	Name of the Course	Category	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
171EE7T18	Utilization of Electrical Energy	PC	3	1	0	4	3
171EE7T19	Linear and Digital IC Applications	PC	3	1	0	4	3
171EE7T20	Power System Operation and Control	PC	3	1	0	4	3
171EE7T21	Switch Gear and Protection	PC	3	1	0	4	3
---	**Professional Elective - IV**	PE	3	1	0	4	3
---	**Professional Elective - V**	PE	3	1	0	4	3
171EE7L09	Power Systems Simulation Lab	PC	0	0	3	3	2
171EE7L10	Micro Processor and Micro Controllers Lab	PC	0	0	3	3	2
171EE7P01	Industry Oriented (Internship) Minor Project	PR	0	0	0	0	1
		TOTAL	**18**	**6**	**6**	**30**	**23**

VIII SEMESTER

Course Code	Name of the Course	Category	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
---	**Professional Elective - VI**	PE	3	1	0	4	3
---	**Open Elective**	OE	3	1	0	4	3
171EE8P02	**Major Project**	PR	0	0	0	0	14
		TOTAL	**6**	**2**	**0**	**8**	**20**

BS: Basic Sciences; HSS: Humanities and Social Sciences; ES: Engineering Sciences; PC: Professional Core; PE: Professional Elective; OE: Open Elective; SS: Self Study Course; PR: Project.

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Professional Elective - I (V Semester)

S.No	Course Code	Name of the Course
1	171EE5E01	Renewable Energy Sources
2	171EE5E02	Modeling and Analysis of Electrical Machines
3	171EE5E03	Electrical Safety

Professional Elective – II (VI Semester)

S.No	Course Code	Name of the Course
1	171EE6E04	Computer Architecture
2	171EE6E05	Electrical Distribution Systems
3	171EE6E06	Distributed Generation and Microgrid

Professional Elective – III (VI Semester)

S.No	Course Code	Name of the Course
1	171EE6E07	Advanced Control Systems
2	171EE6E08	PLC and Applications
3	171EE6E09	Instrumentation
4	171EE6E10	OOPs through JAVA

Professional Elective – IV (VII Semester)

S.No	Course Code	Name of the Course
1	171EE7E11	Optimization Techniques
2	171EE7E12	Digital Signal Processing
3	171EE7E13	Special Electrical Machines

Professional Elective – V (VII Semester)

S.No	Course Code	Name of the Course
1	171EE7E14	High Voltage Engineering
2	171EE7E15	Electric Power Quality
3	171EE7E16	EHVAC Transmission

Professional Elective – VI (VIII Semester)

S.No	Course Code	Name of the Course
1	171EE8E17	HVDC Transmission
2	171EE8E18	Flexible AC Transmission Systems
3	171EE8E19	Power System Reforms
4	171EE8E20	Digital Control Systems

Open Elective (VIII Semester)

S.No	CourseCode	Name of the Course
1	171EE8O01	Energy Audit, Conservation and Management
2	171EE8O02	VLSI Design
3	171EE8O03	Unix and Shell Programming
4	171EE8O04	Neural Networks And Fuzzy Logic
5	171EE8O05	Robotics
6	171EE8O06	Vehicular Electric Power Systems
7	171EE8O07	Internet of Things
8	171EE8O08	Cyber Security

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ANALOG ELECTRONIC CIRCUITS

	L	T	P	C
III Semester **Course Code:** 201EE3T01	3	0	0	3

Course Outcomes: At the end of the Course, Student will be able to:

CO1: Interpret the characteristics of semiconductor diodes.
CO2: Compare the characteristics of rectifiers with and without filters.
CO3: Summarize the characteristics of BJT and FET in different configurations.
CO4: Apply biasing methods for stabilization of BJT and FET amplifiers.
CO5: Interpret small signal low frequency equivalent models of BJT and FET.

Mapping of Course Outcomes with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	1	-	-	-	-	-	-	-	-
CO2	3	1	2	1	-	-	-	-	-	-	-	-
CO3	3	1	2	1	-	-	-	-	-	-	-	-
CO4	3	2	1	1	-	-	-	-	-	-	-	-
CO5	3	1	2	1	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	2	-
CO5	2	-

Unit - I

Junction Diode Characteristics: Review on semiconductor materials, Open circuited PN junction, energy band structure of open circuited PN junction, forward and reverse bias of PN junction, current components in PN junction diode, drift and diffusion currents, law of junction, diode current equation, Breakdown mechanisms, V-I Characteristics, temperature dependence of V-I characteristics, static and dynamic diode resistances, Diffusion and Transition capacitances. Special Semiconductor Diodes: Operation and characteristics of different diodes like Zener Diode, Zener diode applications, LED, Photo diode, Tunnel Diode, Varactor Diode and UJT.

Unit – II

Rectifiers: Block diagram and requirements of Linear mode power supply, Types of rectifiers and their operation, input and output waveforms, derivations of parameters of rectifiers. Filters: Inductor filter, Capacitor filter, L-section filter, π-section filter, multiple L section and multiple π - section filters, comparison of various filter circuits in terms of ripple factor.

Unit – III

Transistor Characteristics: BJT: Construction and operation of a transistor, transistor current components, transistor current equation, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, punch through/reach through, typical transistor junction voltage values. FET: Construction, operation, characteristics and parameters of JFET, depletion and enhancement mode MOSFETs, comparison between JFET and MOSFET.

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Unit – IV

Transistor Biasing and Thermal Stabilization: Need for biasing, load line analysis, basic stability and stability factors(S, S', S"), BJT biasing methods, fixed bias, collector to base bias, self bias, Stabilization against variations in VBE, Ic0 and β, Bias compensation, Thermal runaway, Thermal stability, FET Biasing methods and stabilization

Unit – V

Small Signal Low Frequency Transistor Amplifier Models: BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers. FET: Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.

Text Books:

1. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky, Pearson Publications, 9 th Edition, 2006.
2. Electronic Devices and Circuits, J. Millman, Christos C. Halkias, Tata McGraw Hill, 4th Edition, 2010.

Reference Books:

1. Electronic Devices and Circuits, David A. Bell, Oxford University Press, 5th Edition, 2009.
2. Electronic Devices and Circuits, GK Mittal, Khannan Publishers, 23rd Edition, 2008.

Web Links:

1. http://nptel.ac.in/courses/117103063/11 by Prof. Chitralekha Mahanta, IIT, Gowhati.
2. https://nptel.ac.in/courses/122106025/ by Prof. T.S. Natarajan, IIt, Madras.
3. https://onlinecourses.nptel.ac.in/noc21_ee89/preview by By Prof. Shouribrata chatterjee, IIT Delhi.

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Dept: Of Electrical & Electronics Engineering
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DC MACHINES AND TRANSFORMERS LAB

	L	T	P	C
III Semester	L	T	P	C
Course Code: 201EE3L01	0	0	3	1.5

Course Outcomes: At the end of the Course, Student will be able to:

CO1: Interpret the constructional details of the DC machines and Transformers
CO2: Determine and predetermine the performance of DC machines.
CO3: Analyze the various speed control techniques of DC motor
CO4: Estimate the performance of transformers
CO5: Determine the efficiency and regulation of transformers

Mapping of Course Outcomes with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	1	3	2	1	-	-	-	-	-	-	-	-
CO2	3	1	2	1	-	-	-	-	-	-	-	-
CO3	2	2	1	3	-	-	-	-	-	-	-	-
CO4	3	1	2	1	-	-	-	-	-	-	-	-
CO5	1	1	1	3	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	2	-
CO4	2	-
CO5	1	-

LIST OF EXPERIMENTS

Exp1
To draw open circuit characteristic curves of a given DC shunt generator and to find critical speed & critical field resistance.

Exp2
To draw the performance curves of the DC shunt motor by conducting brake test

Exp3
To determine the efficiencies of two identical shunt machines by conducting regenerative test (Hopkinson's test).

Exp4
To find the efficiency of DC shunt machine by conducting Swinburne's test.

Exp5
To control or change the speed of a given DC shunt motor by field current control method and armature resistance control method and draw speed curve.

Exp6
To draw the internal & external characteristic curves of the given DC Shunt generator by conducting load test

Exp7
To separate the losses in DC shunt motor.

Exp8
To perform OC and SC tests on a single phase transformer and to evaluate efficiency and Regulation and determination of equivalent circuit.

Exp9
To conduct sumpner's test on a two identical single phase transformers and obtain copper losses and core losses and evaluate the efficiency.

Exp10
To make scott connection on the given two 1- Ø transformer and verifying the voltage on the secondary side of the Scott connected transformer.

AugExp1
To analyze the transient response of single phase transformer by simulation

AugExp2
To draw the internal & external characteristic curves of the given DC cumulative compound generator by conducting load test.

AugExp3
To draw the internal & external characteristic curves of the given DC differential compound generator by conducting load test.

AugExp4
To draw the internal & external characteristic curves of the given DC Series Generator by conducting load test.

AugExp5
To separate the Hysteresis and Eddy Current losses of a 1- Ø Transformer.

AugExp6
To make parallel Operation of Two Identical 1- Ø Transformers & Verifying the load sharing.

Reference Books:

1. Electrical Machines by D. P. Kothari, I. J. Nagarth ,McGraw Hill Publications, 4 th edition.
2. Electrical Machines by R. K. Rajput, Lakshmi publications, 5th edition.
3. Electrical Machinery by Abijith Chakrabarthi and Sudhipta Debnath, McGraw Hill education
4. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education
5. Electric Machines by Mulukutla S. Sarma&Mukeshk. Pathak, CENGAGE Learning.

Web Links:

1. .http://nptel.ac.in/courses/108106071
2. http://www.ncert.nic.in/html/learning_basket/electricity/electricity/machine/mach in e_content.htm
3. https://lecturenotes.in/subject/41/electrical-machine-1

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MICROPROCESSOR AND INTERFACING

VI Semester **L T P C**
Course Code: 191EE6T13 **3 0 0 3**

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1: Analyse the generalized concepts of microprocessors
CO 2: Demonstrate programming proficiency using the various addressing modes and instructions.
CO 3: Explain the basic concepts of interfacing memory and peripheral devices to a microprocessor.
CO 4: Develop the internal architecture of microcontroller systems, including counters, timers, ports, and memory.
CO 5: Explain the circuits for various applications using microcontrollers.

Mapping of course outcomes with program outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12
CO 1	2	3	2	1	-	-	-	-	-	-	-	-
CO 2	3	2	2	1	-	-	-	-	-	-	-	-
CO 3	2	3	2	1	-	-	-	-	-	-	-	-
CO 4	2	2	2	1	-	-	-	-	-	-	-	-
CO 5	3	2	2	-	-	-	-	-	-	-	-	1

Mapping of course outcomes with program Specific Outcomes:

CO/PO	PSO1	PSO2
CO 1	1	-
CO 2	1	-
CO 3	1	-
CO 4	1	-
CO 5	1	-

UNIT-I: Introduction to Microprocessor Architecture
Introduction and evolution of Microprocessors – Architecture of 8086 – Memory Organization of 8086 – Register Organization of 8086 – Instruction sets of 8086 – Addressing modes – Assembler directives – Introduction to 80286, 80386, 80486 and Pentium (brief description about architectural advancements only).

UNIT-II: Minimum and Maximum Mode Operations
General bus operation of 8086 – Minimum and Maximum mode operations of 8086 – 8086 Control signal interfacing – Read and write cycle timing diagrams.

UNIT-III: Microprocessors I/O interfacing – I
8255 PPI– Architecture of 8255–Modes of operation– Interfacing I/O devices to 8086 using 8255–Interfacing A to D converters– Interfacing D to A converters– Stepper motor interfacing– Static memory interfacing with 8086.

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UNIT-IV: Microprocessors I/O interfacing – II

Architecture and interfacing of 8251 USART – Architecture and interfacing of 8254 Timer/counter – Architecture and interfacing of DMA controller (8257) – Architecture 8259 Programmable Interrupt Controller (8259) – Command words and operating modes of 8259 – Interfacing of 8259 – Architecture of Keyboard/display controller (8279) – Modes of operation – Command words of 8279 – Interfacing of 8279.

UNIT-V: 8051 Microcontroller:

Overview of 8051 Microcontroller – Architecture– Memory Organization – Register set – I/O ports and Interrupts – Timers and Counters – Serial Communication – Interfacing of peripherals Instruction set.

Text Books:

1. Advanced Microprocessors and Interfacing, Ray and Burchandi, Tata McGraw–Hill.
2. The 8051 Microcontroller Architecture, Programming and Applications, Kenneth J Ayala, Thomson Publishers, 2nd Edition
3. PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18, Muhammad Ali Mazidi, Rolind D. Mckinay, Danny causey -Pearson Publisher.

Reference Books:

1. Microprocessors and Interfacing, Douglas V Hall, Mc Graw Hill, 2nd Edition.
2. A Text book of Microprocessors and Micro Controllers, R.S. Kaler, I.K. International Publishing House Pvt. Ltd.
3. Microcontrollers – Theory and Applications, Ajay V. Deshmukh, Tata McGraw–Hill Companies –2005.
4. Microcontrollers – Principles and Application, Ajit Pal, PHI Learning Pvt Ltd, 2011.

Web Links:

1. https://nptel.ac.in/courses/108/105/108105102/
2. https://nptel.ac.in/courses/117/104/117104072/
3. https://nptel.ac.in/courses/106/108/106108100/
4. https://nptel.ac.in/courses/108/107/108107029/

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Syllabus revision Index for 2021-2022

S. No	Name of the course	Percentage of syllabus change
1	Analog Electronic Circuits	50
2	DC Machines and transformers	20
3	Microprocessor & Interfacing	35

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Department of Electrical and Electronics Engineering

1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	**Analog Electronic Circuits**	**Analog Electronic Circuits**
Course Code	**191EE3T02**	**201EE3T01**
Syllabus	**UNIT-I: Review of Semi-Conductor Physics**: Insulators, Semiconductors, and Metals classification using Energy Band Diagrams, Mobility and Conductivity, Electrons and holes in Intrinsic Semiconductors, Extrinsic Semi-Conductor, (P and N Type semiconductor) Hall effect, Generation and Recombination of Charges, Diffusion. **Junction Diode Characteristics:** Operation and characteristics of p-n junction diode. Current components in p-n diode, diode equation. Temperature dependence on V–I characteristic, diffusion capacitance and diode resistance (static and dynamic), energy band diagram of p-n diode. Special Diodes: Avalanche and Zener break down, Zener characteristics. Light Emitting Diodes.	**UNIT – I: Junction Diode Characteristics**: Review on semiconductor materials, Open circuited PN junction, energy band structure of open circuited PN junction, forward and reverse bias of PN junction, current components in PN junction diode, drift and diffusion currents, law of junction, diode current equation, Breakdown mechanisms, V-I Characteristics, temperature dependence of V-I characteristics, static and dynamic diode resistances, Diffusion and Transition capacitances. Special Semiconductor Diodes: Operation and characteristics of different diodes like Zener Diode, Zener diode applications, LED, Photo diode, Tunnel Diode, Varactor Diode and UJT.
	UNIT-II: Rectifiers and Regulators: Half wave rectifier, ripple factor, full wave rectifier (with and without transformer), harmonic components in a rectifier circuit, Basic filters. Simple circuit of a regulator using Zener diode. Types of regulators-series and shunt voltage regulators, overload protection of voltage regulators. Clipper and Clamper circuits	**UNIT – II: Rectifiers:** Block diagram and requirements of Linear mode power supply, Types of rectifiers and their operation, input and output waveforms, derivations of parameters of rectifiers. Filters: Inductor filter, Capacitor filter, L-section filter, π-section filter, multiple L section and multiple π - section filters, comparison of various filter circuits in terms of ripple factor.

	UNIT-III: Transistors and FET: Junction transistor, transistor current components, transistor as an amplifier and switch. Characteristics of transistor (CE, CB and CC configurations). Transistor biasing and thermal stabilization (to fixed bias, collector to base bias, self-bias). Basics of Field Effect Transistors - Enhancement and depletion mode transfer and drain characteristics.	**UNIT – III Transistor Characteristics:** BJT: Construction and operation of a transistor, transistor current components, transistor current equation, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, punch through/reach through, typical transistor junction voltage values. FET: Construction, operation, characteristics and parameters of JFET, depletion and enhancement mode MOSFETs, comparison between JFET and MOSFET.
	UNIT-IV: Feedback Amplifiers: Classification, feedback concept, transfer gain and general characteristics of negative feedback amplifiers, effect of feedback on input and output resistances. Methods of analysis of feedback amplifiers.	**UNIT – IV: Transistor Biasing and Thermal Stabilization:** Need for biasing, load line analysis, basic stability and stability factors (S, S', S''), BJT biasing methods, fixed bias, collector to base bias, self-bias, Stabilization against variations in VBE, Ic0 and β, Bias compensation, Thermal runaway, Thermal stability, FET Biasing methods and stabilization
	UNIT-V: Power Amplifiers: Classification, push-pull amplifiers, Introduction to harmonics (distortion factor). Oscillators: Condition for oscillation, RC-phase shift oscillator. We in bridge oscillator, Crystal oscillator. Frequency and amplitude stability of oscillator.	**UNIT – V Small Signal Low Frequency Transistor Amplifier Models:** BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers. FET: Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	**Electrical Machines-I**	**DC Machines and transformers**
Course Code	**191EE3T04**	**201EE3L01**
Syllabus	**UNIT-I: Electro Mechanical Energy Conversion:** Principles of electromechanical energy conversion- Magnetic Materials, Permanent Magnets, Electromagnets, B-H Curve – Energy, Co-energy – Forces of electromagnetic origin – Single and multiple excited magnetic field system – Elementary concepts of rotating machines – mmf of distributed winding - Rotating magnetic field – Torque – Magnetic Leakage.	**UNIT – I: Electromechanical Energy Conversion and introduction to DC machines:** Principles of electromechanical energy conversion - singly excited and multi excited systems calculation of force and torque using the concept of co-energy. Construction and principle of operation of DC machines – EMF equation for generator – Excitation techniques– characteristics of DC shunt generator –applications of DC Generators
	UNIT-II: DC Generator: DC Generator- Construction – Lap and wave winding – emf equation-excitation and types of generators-Characteristics - armature reaction-methods of improving commutation-power flow diagram-testing (Hopkinson's test, Field test)-Voltage Regulation-Applications.	**UNIT – II: Operation of DC Motors:** Back-emf and torque equations of dc motors – Armature reaction and commutation – characteristics of separately-excited, shunt, series and compound motors – losses and efficiency – applications of dc motors. Necessity of a starter – starting by 3 point and 4-point starters.
	UNIT-III: DC Motor: DC Motor– Types -Torque equation - Back emf and voltage equations - Characteristics- Starting Speed control - Testing: direct, indirect and regenerative tests-Power flow, efficiency and separation of losses-Retardation test.	**UNIT – III: Speed Control of Motors and Testing of DC Machines & Single-phase Transformers:** Speed control by armature voltage and field control – testing of DC machines – brake test, Swinburne's method – principle of regenerative or Hopkinson's method – retardation test – field's test-separation of losses. Types and constructional details – principle of

		operation –emf equation – operation on no load and on load – lagging, leading and unity power factors loads –phasor diagrams of transformers – equivalent circuit.
	UNIT-IV: Single Phase Transformer: Transformers - Types and constructional details - Principle of operation - Emf equation –Phasor diagrams of transformers – Lagging, leading and unity power factors loads - Equivalent circuit – Regulation – Losses and efficiency – Effect of variation of frequency and supply voltage on losses – All day efficiency.	**UNIT – IV: Performance and Testing of Transformers and Auto Transformers:** Regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – all day efficiency. Tests on single phase transformers – open circuit and short circuit tests – Sumpner's test – separation of losses – parallel operation with equal voltage ratios – auto transformer – equivalent circuit – comparison with two winding transformers
	UNIT-V: Single-Phase Transformers Testing: Tests on single phase transformers – Open circuit and short circuit tests – Sumpner's test – separation of losses – Parallel operation with equal voltage ratios – Auto transformer - Equivalent circuit – Comparison with two winding transformers. **3-Phase Transformer** Poly phase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ - Third harmonics in phase voltages - Three winding transformers - Determination of Zp, Zs and Zt- Transients in switching - Off load and on load tap changers - Scott connection.	**Unit – V Three Phase Transformers:** Poly phase connections- Y/Y, Y/ Δ, Δ/Y, Δ/ Δ and open Δ- third harmonics in phase voltages – three winding transformers- transients in switching – off load and on load tap changers-Scott connection.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	**Micro Processor and Micro Controllers**	**Microprocessor & Interfacing**
Course Code	**171EE6T16**	**191EE6T13**
Syllabus	**UNIT I: Introduction to Microprocessor architecture:** Introduction and evolution of Microprocessors, Architecture of 8086, Register Organization of 8086, Memory organization of 8086, General bus operation of 8086, Introduction to 80286,80386 and 80486 and Pentium.	**UNIT-I: Introduction to Microprocessor Architecture** Introduction and evolution of Microprocessors – Architecture of 8086 – Memory Organization of 8086 – Register Organization of 8086 – Instruction sets of 8086 – Addressing modes – Assembler directives – Introduction to 80286, 80386, 80486 and Pentium (brief description about architectural advancements only).
	UNIT II: Minimum and maximum mode operations: Instruction set, addressing modes, assembler directives, Minimum and Maximum mode operations of 8086, 8086 Control signal interfacing, Read and write cycle timing diagrams.	**UNIT-II: Minimum and Maximum Mode Operations:** General bus operation of 8086 – Minimum and Maximum mode operations of 8086 – 8086 Control signal interfacing – Read and write cycle timing diagrams.
	UNIT III: 8086 interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8259 programmable interrupt controller, Intel 8237a DMA controller, Intel 8255 programmable peripheral interface, Intel 8279 programmable keyboard/display controller, keyboard interfacing, stepper motor, A/D and D/A converters.	**UNIT-III: Microprocessors I/O interfacing – I:** 8255 PPI– Architecture of 8255–Modes of operation–Interfacing I/O devices to 8086 using 8255–Interfacing A to D converters–Interfacing D to A converters– Stepper motor interfacing– Static memory interfacing with 8086.
	UNIT IV: Introduction to 8051 micro controllers: Overview of 8051 Micro Controller, Architecture, Register set, I/O ports	**UNIT-IV: Microprocessors I/O interfacing – II** Architecture and interfacing of 8251 USART – Architecture and interfacing

	and Memory Organization, Interrupts, Timers and Counters, Serial Communication. **PIC architecture:** Block diagram of basic PIC 18 micro controller, registers I/O ports.	of 8254 Timer/counter – Architecture and interfacing of DMA controller (8257) – Architecture 8259 Programmable Interrupt Controller (8259) – Command words and operating modes of 8259 – Interfacing of 8259 – Architecture of Keyboard/display controller (8279) – Modes of operation – Command words of 8279 – Interfacing of 8279.
	UNIT V: Cyber physical systems and industrial applications of 8051: Applications of Micro Controllers, Interfacing 8051 to LED's, Push button, Relay's and Latch Connections, Keyboard Interfacing, Interfacing Seven Segment Display, ADC and DAC Interfacing.	**UNIT-V: 8051 Microcontroller:** Overview of 8051 Microcontroller – Architecture– Memory Organization – Register set – I/O ports and Interrupts – Timers and Counters – Serial Communication – Interfacing of peripherals Instruction set.

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Program Name : B.Tech. in Mechanical Engineering

Syllabus Revision for the Academic Year 2021-2022

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
1	I	201HS1T01	Communicative English	0
2	I	201BS1T01	Differential Equations and Linear Algebra	0
3	I	201BS1T02	Engineering Physics	0
4	I	201ES1T03	Essential Electrical and Electronics Engineering	0
5	I	201ES1T05	Engineering Graphics	0
6	I	201HS1L01	Communicative English Lab	0
7	I	201BS1L01	Engineering Physics Lab	0
8	I	201ES1L03	Essential Electrical and Electronics Engineering Lab	0
9	I	201MC1T01	Environment Science	0
10	II	201BS2T05	Partial Differential Equations and Vector Calculus	0
11	II	201BS2T08	Chemistry of Materials	0
12	II	201ES2T06	Engineering Mechanics	0
13	II	201ES2T08	Programming for Problem Solving using C	0
14	II	201ES2L07	Engineering Workshop	0
15	II	201ES2L12	Computer Aided Drafting Lab	0
16	II	201HS2L02	Professional Communications Skills Lab	0
17	II	201BS2L05	Engineering Chemistry Lab	0
18	II	201ES2L10	Programming for Problem Solving using C Lab	0
19	II	201MC2T02	Constitution of India	0
20	III	201BS3T12	Integral Transforms and Applications of partial differential equations	0
21	III	201ME3T01	Production Technology	0
22	III	201ME3T02	Fluid Mechanics & Hydraulic Machines	0
23	III	201ES3T15	Thermodynamics	0
24	III	201ES3T16	Metallurgy &Material Science	5
25	III	201ME3T01	Computer Aided Machine Drawing Lab	10

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
26	III	201ME3L01	Production Technology Lab	0
27	III	201ME3L02	Fluid Mechanics & Hydraulic Machines Lab	0
28	III	201SC3L03	Skill oriented Course-I(Java Programming Lab)	100
29	III	201MC3T03	Biology For Engineers	0
30	IV	201BS4T15	Numerical methods& Statistical Techniques	0
31	IV	201HS4T04	Industrial Engineering and Management	0
32	IV	201ME4T03	Mechanics of Solids	0
33	IV	201ME4T04	Theory of Machines-I	20
34	IV	201ME4T05	Thermal Engineering-I	15
35	IV	201ME4L04	Theory of Machines Lab	6
36	IV	201ME4L05	Mechanics of Solids &Metallurgy Lab	0
37	IV	201ME4L06	Thermal Engineering Lab	6
38	IV	201SC4L15	Python Programming Lab	100
39	IV	201MC4T04	Essence of Indian Traditional Knowledge	0
40	V	191ME5T09	Dynamics of Machinery	6
41	V	191ME5T10	Design of Machine members-I	0
42	V	191ME5T11	Thermal Engineering -II	0
43	V	191ME5E01	Automobile Engineering	0
44	V	191ME5E02	Composite Materials	100
45	V	191ME5E03	Fluid Engineering	40
46	V	191ME5E04	Mechanical Vibrations	25
47	V	191ME5E05	Metrology &Instrumentation	0
48	V	191ME5E06	Organizational Behavior	100
49	V	191CE5O01	Basic Concrete Technology	100
50	V	191EE5O01	Electrical Safety	100
51	V	191EE5O02	Electrical Materials	100
52	V	191EE5O03	Basic electrical Measurements	100
53	V	191EC5O01	Signals& Systems	100
54	V	191EC5O02	Digital Electronics& Logic Design	100
55	V	191EC5O03	Semi-conductor devices	100
56	V	191CS5O01	Data structures	100
57	V	191CS5O02	Object oriented programming through C++	100

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
58	V	191CS5O03	Java Programming	100
59	V	191CS5O04	R programming	100
60	V	191IT5O01	Data Base Management Systems	100
61	V	191IT5O02	Computer Graphics	100
62	V	191MI5O01	Overview of Mining	100
63	V	191PT5O01	Process Intensification in Petroleum industry	100
64	V	191PT5O02	Fundamentals of Petroleum Industry	100
65	V	191AG5O01	Basic Crop Production Practices	100
66	V	191ME5L05	Metrology/ICS Lab	0
67	V	191ME5L06	Theory of Machines Lab	0
68	V	191ME5L07	Thermal Engineering Lab	0
69	V	191HS5T06	Employability Skills -III	0
70	V	191PR5P02	Socially Relevant Project	100
71	V	191MC5A08	Intellectual Property Rights and Patents	0
72	VI	191ME6T12	Heat Transfer	0
73	VI	191ME6T13	Design of Machine members-II	0
74	VI	191ME6T14	Metal Cutting and Machine Tools	10
75	VI	191ME6E07	Industrial Engineering and Management	0
76	VI	191ME6E08	Mechatronics	20
77	VI	191ME6E09	Non-Destructive Evaluation	0
78	VI	191ME6E10	Refrigeration and Air Conditioning	0
79	VI	191ME6E11	Robotics	0
80	VI	191ME6E12	Additive Manufacturing	40
81	VI	191ME6E13	Alternative Fuels	100
82	VI	191ME6E14	Design for Manufacturing	0
83	VI	191ME6E15	Green Engineering Systems	0
84	VI	191ME6E16	Lean Manufacturing	100
85	VI	191CE6O02	Disaster Management	100
86	VI	191EE6O04	Energy Audit and Conservation Management	100
87	VI	191EE6O05	Non-Conventional Energy Resources	100
88	VI	191EE6O06	Instrumentation	100
89	VI	191EC6O04	Biomedical Instrumentation	100

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
90	VI	191EC6O05	ECAD Tools	100
91	VI	191CS6O05	Python Programming	100
92	VI	191CS6O06	Operating Systems	100
93	VI	191CS6O07	Web Technologies	100
94	VI	191CS6O08	Cyber Security	100
95	VI	191CS6O09	AR/VR	100
96	VI	191IT6O03	Computer Organization	100
97	VI	191IT6O04	AI Tools & Techniques	100
98	VI	191IT6O05	Robotic Process Automation	100
99	VI	191MI6O02	Industrial Safety Practices	100
100	VI	191MI6O03	Electrical Equipment's in Mines	100
101	VI	191PT6O03	Unconventional Hydrocarbon Resources	100
102	VI	191PT6O04	Asset Management	100
103	VI	191AG6O02	Weather Forecast in Agriculture	100
104	VI	191AG6O03	Bio-energy Systems Design and Applications	100
105	VI	191ME6L08	Machine Cutting and Machine Tools Lab	0
106	VI	191ME6L09	Heat Transfer Lab	0
107	VI	191HS6T07	Employability skills-IV	0
108	VI	191MC6A09	Professional Ethics and Human Values	0
109	VII	171ME7T16	CAD/CAM	0
110	VII	171ME7T17	Mechatronics	0
111	VII	171ME7T18	Finite Element Methods	0
112	VII	171ME7T19	Power Plant Engineering	0
113	VII	171ME7E10	Computational Fluid Dynamics	0
114	VII	171ME7E11	Green Engineering Systems	0
115	VII	171ME7E12	Nano Materials and Technology	0
116	VII	171ME7E13	Gas Dynamics	0
117	VII	171ME7E14	Condition Monitoring	0
118	VII	171ME7E15	Flexible Manufacturing Systems	0
119	VII	171ME7L07	CAD/CFD Lab	0
120	VII	171ME7L08	CAM/Mechatronics Lab	0
121	VII	171ME7P01	Industry Oriented (Internship) Mini Project	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
122	VIII	171ME8E16	Production Planning and Control	0
123	VIII	171ME8E17	Advanced Materials	0
124	VIII	171ME8E18	Thermal Equipment Design	0
125	VIII	171EE8O04	Neural Networks and Fuzzy Logic	0
126	VIII	171CE8O02	Data Base Management Systems	0
127	VIII	171ME8P02	Major Project	0
Total number of courses in the academic year 2021-2022				**127**
Number of courses having revision in syllabus content >/= 20% in the academic year 2021-2022				**49**
Percentage of syllabus revision carried out in the academic year 2021-2022 = (49/129)*100				**38.58**

Program Coordinator

Head of the Department

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PROGRAM STRUCTURE

I SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201HS1T01	Communicative English	HSC	Theory	3	0	0	3	3
201BS1T01	Differential equations and Linear algebra	BSC	Theory	3	0	0	3	3
201BS1T02	Engineering Physics	BSC	Theory	3	0	0	3	3
201ES1T03	Essential Electrical and Electronics Engineering	ESC	Theory	3	0	0	3	3
201ES1T05	Engineering Graphics	ESC	Theory	1	0	4	5	3
201HS1L01	Communicative English Lab	HSC	Lab	0	0	3	3	1.5
201BS1L01	Engineering Physics Lab	BSC	Lab	0	0	3	3	1.5
201ES1L03	Essential Electrical and Electronics Engineering Lab	ESC	Lab	0	0	3	3	1.5
201MC1T01	Environmental Science	MC	Theory	2	0	0	2	0
			TOTAL	**15**	**0**	**13**	**28**	**19.5**

II SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS2T05	Partial Differential Equations and Vector Calculus	BSC	Theory	3	0	0	3	3
201BS2T08	Chemistry of Materials	BSC	Theory	3	0	0	3	3
201ES2T06	Engineering Mechanics	ESC	Theory	3	0	0	3	3
201ES2T08	Programming for Problem Solving Using C	ESC	Theory	3	0	0	3	3
201ES2L07	Engineering Workshop	ESC	Lab	0	0	3	3	1.5
201ES2L12	Computer Aided Drafting Lab	ESC	Lab	0	0	3	3	1.5
201HS2L02	Professional Communications Skills Lab	HSC	Lab	0	0	3	3	1.5
201BS2L05	Engineering Chemistry Lab	BSC	Lab	0	0	3	3	1.5
201ES2L10	Programming for Problem Solving Using C Lab	ESC	Lab	0	0	3	3	1.5
201MC2T02	Constitution of India	MC	Theory	2	0	0	2	0
			TOTAL	**14**	**0**	**15**	**29**	**19.5**

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III SEMESTER								
Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS3T12	Integral Transforms And Applications Of Partial Differential Equations	BSC	Theory	3	0	0	3	3
201ME3T01	Production Technology	PCC	Theory	3	0	0	3	3
201ME3T02	Fluid Mechanics and Hydraulic Machines	PCC	Theory	3	0	0	3	3
201ES3T15	Thermodynamics	ESC	Theory	3	0	0	3	3
201ES3T16	Metallurgy and MaterialScience	ESC	Theory	3	0	0	3	3
201ME3L01	Computer Aided Machine Drawing Lab	PCC	Lab	0	0	3	3	1.5
201ME3L02	Production Technology Lab	PCC	Lab	0	0	3	3	1.5
201ME3L03	Fluid Mechanics and Hydraulic Machines Lab	PCC	Lab	0	0	3	3	1.5
201SC3L03	**Skill Oriented Course-I** Java Programming Lab	SC	Lab	0	0	4	4	2
201MC3T03	Biology for Engineers	MC	Theory	2	0	0	2	0
			TOTAL	**17**	**0**	**13**	**30**	**21.5**

IV SEMESTER								
Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS4T15	Numerical methods and Statistical Techniques	BSC	Theory	3	0	0	3	3
201HS4T04	Industrial Engineering and Management	HSC	Theory	3	0	0	3	3
201ME4T03	Mechanics of Solids	PCC	Theory	3	0	0	3	3
201ME4T04	Theory of Machines-I	PCC	Theory	3	0	0	3	3
201ME4T05	Thermal Engineering-I	PCC	Theory	3	0	0	3	3
201ME4L04	Theory of Machines Lab	PCC	Lab	0	0	3	3	1.5
201ME4L05	Mechanics of Solids and Metallurgy Lab	PCC	Lab	0	0	3	3	1.5
201ME4L06	Thermal Engineering Lab	PCC	Lab	0	0	3	3	1.5
201ME4S01	**Skill Oriented Course-II** Python ProgrammingLab	SC	Lab	0	0	4	4	2
201MC4T04	Essence of Indian Traditional Knowledge	MC	Theory	2	0	0	2	0
			TOTAL	**17**	**0**	**13**	**30**	**21.5**

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V SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week				Credits (C)
			Lecture(L)	Tutorial (T)	Practice (P)	Total Hours	
191ME5T09	Dynamics of Machinery	PCC	3	0	0	3	3
191ME5T10	Design of Machine Members-I	PCC	3	0	0	3	3
191ME5T11	Thermal Engineering-II	PCC	3	0	0	3	3
----	Professional Elective-I	PEC	3	0	0	3	3
----	Open Elective-I	OEC	3	0	0	3	3
191ME5L05	Metrology and ICS lab	PCC	0	0	3	3	1.5
191ME5L06	Theory of Machines Lab	PCC	0	0	3	3	1.5
191ME5L07	Thermal Engineering Lab	PCC	0	0	3	3	1.5
191HS5T06	Employability Skills – III	HSMC	0	0	2	2	1
191PR5P02	Socially Relevant Project	PROJ	0	0	2	2	1
191MC5A08	Intellectual Property Rights and Patents	MC	2	0	0	2	0
		TOTAL	**15**	**0**	**13**	**28**	**21.5**

VI SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
191ME6T12	Heat Transfer	PCC	3	0	0	3	3
191ME6T13	Design of Machine Members-II	PCC	3	0	0	3	3
191ME6T14	Metal cutting and Machine Tools	PCC	3	0	0	3	3
----	Professional Elective-II	PEC	3	0	0	3	3
----	Professional Elective-III	PEC	3	0	0	3	3
----	Open Elective-II	OEC	3	0	0	3	3
191ME6L08	Metal Cutting and Machine Tools Lab	PCC	0	0	3	3	1.5
191ME6L09	Heat Transfer Lab	PCC	0	0	3	3	1.5
191HS6T07	Employability Skills – IV	HSMC	0	0	2	2	1
191MC6A09	Professional Ethics and Human Values	MC	2	0	0	2	0
		TOTAL	**18**	**0**	**8**	**26**	**22**

VII SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
191ME7T15	Operations Research	PCC	3	0	0	3	3
191ME7T16	Finite Element Methods	PCC	3	0	0	3	3
----	Professional Elective-IV	PEC	3	0	0	3	3
----	Professional Elective-V	PEC	3	0	0	3	3
----	Open Elective-III	OEC	3	0	0	3	3
191ME7L10	CAM/ Mechatronics Lab	PCC	0	0	3	3	1.5
191ME7L11	CAD/ CFD lab	PCC	0	0	4	4	2
191ME7P03	Internship	PROJ	0	0	0	0	2
191ME7P04	Project Part 1	PROJ	0	0	0	0	2
		TOTAL	**15**	**0**	**7**	**22**	**22.5**

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PROFESSIONAL ELECTIVES

Professional Elective – I			Professional Elective – II		
S.No	**Course Code**	**Name of the Course**	**S.No**	**Course Code**	**Name of the Course**
1	191ME5E01	Automobile Engineering	1	191ME6E07	Industrial Engineering & Management
2	191ME5E02	Composite Materials	2	191ME6E08	Mechatronics
3	191ME5E03	Fluid Engineering	3	191ME6E09	Non Destructive Evaluation
4	191ME5E04	Mechanical Vibrations	4	191ME6E10	Refrigeration and Air Conditioning
5	191ME5E05	Metrology & Instrumentation	5	191ME6E11	Robotics
6	191ME5E06	Organizational Behavior			
Professional Elective – III			**Professional Elective – IV**		
S.No	**Course Code**	**Name of the Course**	**S.No**	**Course Code**	**Name of the Course**
1	191ME6E12	Additive Manufacturing	1	191ME7E17	Advanced Automobile Engineering
2	191ME6E13	Alternative Fuels	2	191ME7E18	Advanced Fluid Mechanics
3	191ME6E14	Design for Manufacturing	3	191ME7E19	Computational Fluid Dynamics
4	191ME6E15	Green Engineering Systems	4	191ME7E20	Nano materials & Technology
5	191ME6E16	Lean Manufacturing	5	191ME7E21	Power Plant Engineering
Professional Elective – V			**Professional Elective – VI**		
S.No	**Course Code**	**Name of the Course**	**S.No**	**Course Code**	**Name of the Course**
1	191ME7E22	CAD/ CAM	1	191ME8E27	Advanced Materials
2	191ME7E23	Condition Monitoring	2	191ME8E28	Manufacturing Methods in Precision Engineering
3	191ME7E24	Product Design and Development	3	191ME8E29	Production Planning and Control
4	191ME7E25	Flexible Manufacturing Systems	4	191ME8E30	Thermal Equipment Design
5	191ME7E26	Gas Dynamics	5	191ME8E31	Total Quality Management

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Note : Open Elective Course (OEC) must be selected from the list of Open Elective Courses offered by Other Department(s) only.

OPEN ELECTIVE – I (V Semester)

S. No	Course Code	Course Name	Offered By Department
1	191CE5O01	Basic Concrete Technology	CE
2	191EE5O01	Electrical Safety	EEE
3	191EE5O02	Electrical Materials	EEE
4	191EE5O03	Basic Electrical Measurements	EEE
5	191ME5O01	Renewable Energy Sources	ME
6	191ME5O02	Fundamentals of Mechanical Engineering	ME
7	191ME5O03	Supply Chain Management	ME
8	191ME5O04	3D Printing	ME
9	191ME5O05	Entrepreneurship Development and Incubation	ME
10	191EC5O01	Signals and Systems	ECE
11	191EC5O02	Digital Electronics and Logic Design	ECE
12	191EC5O03	Semi conductor devices	ECE
13	191CS5O01	Data Structures	CSE
14	191CS5O02	Object Oriented Programming through C++	CSE
15	191CS5O03	Java Programming	CSE
16	191CS5O04	R Programming	CSE
17	191IT5O01	Database Management Systems	IT
18	191IT5O02	Computer Graphics	IT
19	191MI5O01	Overview of Mining	Min.E
20	191PT5O01	Process Intensification in Petroleum Industry	PT
21	191PT5O02	Fundamentals of Petroleum Industry	PT
22	191AG5O01	Basic Crop Production Practices	Ag.E

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OPEN ELECTIVE – II (VI Semester)

S. No	Course Code	Course Name	Offered By Department
1	191CE6O02	Disaster Management	CE
2	191EE6O04	Energy Audit and Conservation Management	EEE
3	191EE6O05	Non-Conventional Energy Sources	EEE
4	191EE6O06	Instrumentation	EEE
5	191ME6O06	Solar Energy Utilisation	ME
6	191ME6O07	Basic Thermodynamics and Heat Transfer	ME
7	191ME6O08	Introduction to Hydraulics and Pneumatics	ME
8	191ME6O09	3D Printing	ME
9	191ME6O10	Robotics	ME
10	191ME6O11	Management Science	ME
11	191ME6O12	Entrepreneurship Development and Incubation	ME
12	191EC6O04	Biomedical Instrumentation	ECE
13	191EC6O05	ECAD Tools	ECE
14	191CS6O05	Python Programming	CSE
15	191CS6O06	Operating Systems	CSE
16	191CS6O07	Web Technologies	CSE
17	191CS6O08	Cyber Security	CSE
18	191CS6O09	AR / VR	CSE
19	191IT6O03	Computer Organization	IT
20	191IT6O04	AI Tools & Techniques	IT
21	191IT6O05	Robotic Process Automation	IT
22	191MI6O02	Industrial Safety Practices	Min.E
23	191MI6O03	Electrical Equipment in Mines	Min.E
24	191PT6O03	Unconventional Hydrocarbon Resources	PT
25	191PT6O04	Asset Management	PT
26	191AG6O02	Weather forecast in Agriculture	Ag.E
27	191AG6O03	Bio-energy systems design and applications	Ag.E

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VII SEMESTER

Course Code	Course Title	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
171ME7T16	CAD / CAM	PC	3	1	---	4	3
171ME7T17	Mechatronics	PC	3	1	---	4	3
171ME7T18	Finite Element Methods	PC	3	1	---	4	3
171ME7T19	Power Plant Engineering	PC	3	1	---	4	3
---	Professional Elective - IV	PE	3	1	---	4	3
---	Professional Elective - V	PE	3	1	---	4	3
171ME7L07	CAD / CFD Lab	PC	---	---	3	3	2
171ME7L08	CAM / Mechatronics Lab	PC	---	---	3	3	2
171ME7P01	Industry Oriented (Internship) Minor Project	PR	---	---	---	---	1
		TOTAL	18	6	6	30	23

VIII SEMESTER

Course Code	Course Title	Course Component	Total Number of contact hours				Credits(C)
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
---	Professional Elective - VI	PE	3	1	---	4	3
---	Open Elective	OE	3	1	---	4	3
171ME8P02	Major Project	PR	---	---	---	---	14
		TOTAL	6	2	---	8	20

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Professional Elective – I (V Semester)

S.No	Course Code	Name of the Course
1	171ME5E01	Automobile Engineering
2	171ME5E02	Mechanical Vibrations
3	171ME5E03	Additive Manufacturing

Professional Elective – II (VI Semester)

S.No	Course Code	Name of the Course
1	171ME6E04	Robotics
2	171ME6E05	Design for Manufacturing
3	171ME6E06	Non-Destructive Evaluation

Professional Elective – III (VI Semester)

S.No	Course Code	Name of the Course
1	171ME6E07	Unconventional Machining Processes
2	171ME6E08	Industrial Hydraulics and Pneumatics
3	171ME6E09	Quality and Reliability Engineering

Professional Elective – IV (VII Semester)

S.No	Course Code	Name of the Course
1	171ME7E10	Computational Fluid Dynamics
2	171ME7E11	Green Engineering Systems
3	171ME7E12	Nano Materials and Technology

Professional Elective – V (VII Semester)

S.No	Course Code	Name of the Course
1	171ME7E13	Gas Dynamics
2	171ME7E14	Condition Monitoring
3	171ME7E15	Flexible Manufacturing Systems

Professional Elective – VI (VIII Semester)

S.No	Course Code	Name of the Course
1	171ME8E16	Production Planning and Control
2	171ME8E17	Advanced Materials
3	171ME8E18	Thermal Equipment Design

Open Elective (VIII Semester)

S.No	Course Code	Name of the Course
1	171ME8O01	Java Programming
2	171ME8O02	Electrical Safety Management
3	171EE8O04	Neural Networks And Fuzzy Logic
4	171CE8O02	Database Management Systems
5	171ME8O03	Entrepreneur Resource Planning
6	171ME8O04	Computer Graphics

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THEORY OF MACHINES -I

IV Semester
Course Code: 201ME4T04

L	T	P	C
3	0	0	3

Course Outcomes:

At the end of the Course, Student will be able to:

- CO1: Explain the inversions of a kinematic chain and its applications
- CO2: Construct the velocity and acceleration diagrams using Relative velocity method and Instantaneous centre method.
- CO3: Construct displacement diagram and profile of Cam with different types of follower motions.
- CO4: Calculate the velocities of different components of a Compound gear train and Epicyclic gear train
- CO5: Construct the turning moment diagram of a flywheel

Mapping of Course Outcomes with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	1	1	1	-	-	-	-	-	-	-	-
CO2	2	2	1	1	-	-	-	-	-	-	-	-
CO3	2	2	2	1	-	-	-	-	-	-	-	-
CO4	3	2	2	1	-	-	-	-	-	-	-	-
CO5	3	2	-	-	3	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

Unit - I

Classification of Mechanisms-Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain -Limit positions- Mechanical advantage- Description of some common mechanisms- Crank and Slotted Lever mechanism, Quick Return Motion mechanism, Davis and Ackermann Steering gear mechanisms, Hooke's joint.

Unit – II

Kinematics: Plane motion of body: Instantaneous centre of rotation, centrode and axode - Relative motion between two bodies – Kennedy's Theorem – Graphical determination of instantaneous centre for Four bar and Single Slider Crank chain mechanisms, Determination of Angular Velocity of points and links.

Motion of a Link in Machine - Determination of Displacement, Velocity and Acceleration for a Four Bar Mechanism, Single Slider Crank chain mechanism, Double Slider Crank chain mechanism

Unit – III

CAMS: Definition and classification of Cams and Followers - Terminology - Types of follower motion: Uniform velocity, Simple harmonic motion and Uniform Acceleration and Retardation, Cycloidal motion for Knife edge, Flat face and Roller follower and offset follower.

Unit – IV

Power Transmission: Introduction –Modes of Power Transmission applications.

Gears and Gear Trains: Classification, Terminology, Law of Gearing, Path of contact, Arc of contact. Interference, Methods of avoiding interferences. Simple gear train, Compound gear train, reverted gear train, epicyclic gear train and Differential. Table method to find velocity of components of a gear train.

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Unit – V

Turning Moment Diagrams:Static and dynamic force analysis of planar mechanisms, Dynamic force analysis of slider crank mechanism, Inertia Torque, Angular Velocity and Acceleration of connecting rod, Crank Effort and Turning Moment Diagrams – Fluctuation of energy – Fly Wheel design.

Text Books:

1. Theory of machines by S.S.Rattan, 5th Edition, Tata Mc Graw Hill, 2019
2. Theory of machines by Thomas Bevan, 3rd Edition, CBS Publishers, 2005

Reference Books:

1. Theory of machines: kinematics and dynamics by Sadhu Singh, 3rd Edition, Pearson Publishers, 2012.
2. Theory of machines by R.K.Bansal, J.S.Brar,6th Edition, Laxmi Publications, 2016.

Web Links:

1. https://nptel.ac.in/courses/112/104/112104121/
2. https://nptel.ac.in/courses/112/104/112104114/

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FLUID ENGINEERING
(Professional Elective –I)

V semester **L T P C**
Course Code:191ME5E03 **3 0 0 3**

Course Outcomes:

At the end of the Course, Student will be able to:

CO 1: Explain the working of various types of reciprocating compressor
CO 2: Evaluate efficiency of various types of rotary compressors
CO 3: Compare different types of Turbines and its characteristics
CO 4: Calculate performance of centrifugal pump.
CO 5: Calculate performance of Reciprocating Pump

Mapping of course outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12
CO1	2	1	-	-	2	2	-	-	-	-	-	-
CO2	3	2	-	-	2	2	-	-	-	-	-	-
CO3	2	2	1	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-

Mapping of course outcomes with Program Specific Outcomes:

CO / PSO	PSO1	PSO2
CO1	-	2
CO2	-	2
CO3	-	3
CO4	-	2
CO5	-	2

UNIT –I:

Compressors: Classification Positive displacement and Roto dynamic machinery Power producing and power absorbing machines, Fan, Blower and Compressor Positive displacement and dynamic types Reciprocating and rotary types.

Reciprocating Compressor: Principle of operation, Work required, Isothermal efficiency, Volumetric efficiency and effect of clearance, Multi stage compression, Under cooling, Saving of work, Minimum work condition for two stage compression.

UNIT-II:

Rotary Compressor (Positive Displacement Type): Roots Blower, Vane sealed compressor, Lysholm compressor, Mechanical details and Principle of working Efficiency considerations.

Centrifugal Compressors: Mechanical details and principle of operation Velocity and pressure variation. Energy transfer-Impeller blade shape-losses, Slip factor, Power input factor, Pressure coefficient and adiabatic coefficient Velocity diagrams Power.

Axial Flow Compressors: Mechanical details and principle of operation Velocity triangles and energy transfer per stage degree of reaction, Work done factor - Isentropic efficiency- Pressure rise calculations Polytropic efficiency.

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UNIT-III:

Hydraulic Machines: Turbines

Velocity Triangles and Work done for a Pelton Wheel, Design of Pelton Wheel, Radial Flow reaction Turbines- Inward & Outward; Degree of reaction; Francis Turbine; Axial Flow Reaction Turbines; Draft Tube; Specific Speed; Unit Quantities; Characteristic curves of Hydraulic turbines and governing of turbines.

UNIT-IV:

Centrifugal Pumps:

Work done by the Centrifugal Pump; Heads and efficiencies; Minimum speed to start, Multistage, Specific speed, Model testing; Priming; Characteristic curves; Cavitation; Maximum suction Lift; Net positive Suction Head.

UNIT-V:

Reciprocating Pumps:

Discharge, Work done and power required calculations; Slip; Variation of velocity and acceleration in suction and delivery pipes; Effect of variation of velocity on friction in the suction and delivery pipes; Indicator diagram; Air vessels and Comparison of Centrifugal and Reciprocating Pumps.

Textbooks:

1. Heat Engines,V.P. Vasandani & D.S. Kumar, Metropolitan Book Co. Pvt. Ltd, 4th Edition.
2. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Publications (P) Ltd., 9th Edition.

Reference Books:

1. Thermal Engineering, R.K Rajput, Lakshmi Publications, 10th Edition.
2. Thermal Engineering, PL Ballaney, Khanna Publishers, 25th Edition.
3. Fluid Mechanics and Hydraulic Machines, K.L Kumar, S.Chand publications, 2008.
4. Hydraulics and Fluid mechanics including Hydraulics machines by P.N.Modi& S.M.Seth, Rajsons publications pvt ltd. Standard Book House (2017 edition).
5. Mechanics of fluids by Bernard Massey, 9th Edition, CRC Press, 2019.

Weblinks:

1. http://nptel.ac.in/courses/112104033/
2. http://www.science-animations.com/fluidmechanics.html
3. https://iitbmechdamp.wordpress.
4. https://ocw.mit.edu/courses

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MECHANICAL VIBRATIONS

(Professional Elective –I)

V semester **L T P C**
Course Code:191ME5E04 **3 0 0 3**

Course Outcomes:
At the end of the Course, Student will be able to:

- CO 1: Analyze the various 1-D periodic and periodic responses of an vibrating system with and without damping.
- CO 2: Analyze the two degree freedom systems with and without damping for free and forced vibrations.
- CO 3: Solve Multi-degree freedom systems emphasing on modal analysis techniques.
- CO 4: Estimate frequency of multi degree freedom systems using numerical methods.
- CO 5: Apply the knowledge of the various physical vibration measuring instruments.

Mapping of course outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12
CO1	3	2	2	1	-	-	-	-	-	-	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	-
CO3	2	2	2	1	-	-	-	-	-	-	-	-
CO4	2	2	2	1	-	-	-	-	-	-	-	-
CO5	2	2	2	1	-	-	-	-	-	-	-	-

Mapping of course outcomes with Program Specific Outcomes:

CO/PSO	PSO 1	PSO 2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

UNIT-I:

Single degree of Freedom systems: Undamped and damped free vibrations: forced vibrations ; coulomb damping; Response to harmonic excitation; rotating unbalance and support excitation, Vibration isolation and transmissibility.

UNIT-II:

Vibration Measurement: Vibrometers, velocity meters & accelerometers Two degree of freedom systems: Principal modes – undamped and damped free and forced vibrations; undamped vibration absorbers.

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UNIT-III:

Multi degree of freedom systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi – rotor systems and geared systems; Discrete Time systems.

UNIT-IV:

Numerical Methods: Rayleigh's, stodola's, Matrix iteration, Rayleigh-Ritz Method and Holzer's methods

UNIT-V:

Application of concepts: Free vibration of strings – longitudinal oscillations of bars-transverse vibrations of beams- Torsional vibrations of shafts. Critical speeds without and with damping, secondary critical speed.

Textbooks:

1. Theory of Vibrations with Applications 5th Edition: William T. Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan, John Vlissides.
2. Mechanical Vibrations 8th Edition – G.K. Grover.

Reference Books:

1. Vibration problems in Engineering by S.P. Timoshenko.
2. Mechanical Vibrations – Schaum series.
3. Mechanical Vibrations 4th Edition : Singiresu S. Rao.
4. Vibration and Acoustics 1st EditionC. Sujatha.
5. Elements of Vibration Analysis by Meirovitch.

Web Links:

1. http://nptel.ac.in/courses/112103112/
2. http://www.engineeringcareer.in/wpcontent/uploads/2017/02/ Mechanical-
3. Vibrations-By-V.P.-Singh.pdf

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MECHATRONICS

(Professional Elective –II)

VI Semester
Course Code: 191ME6E08

L	T	P	C
3	0	0	3

Course Outcomes:
At the end of the Course, Student will be able to:

- CO 1 Summarize the different types of mechatronics systems and sensors.
- CO 2 Classify the different types of solid-state electronic devices, microprocessor, and micro controller.
- CO 3 Describe various types of actuators.
- CO 4 Construct a program in PLC.
- CO 5 Make use of data interfacing and data acquisition.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12
CO1	1	2	2	-	-	1	-	-	-	-	-	-
CO2	-	2	-	-	1	-	-	-	-	-	-	-
CO3	1	2	2	-	-	1	-	-	-	-	-	-
CO4	-	-	-	-	1	-	-	-	-	-	1	-
CO5	-	1	-	-	2	-	-	-	-	-	1	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PO	PSO1	PSO2
CO1	1	-
CO2	-	-
CO3	1	-
CO4	-	-
CO5	-	-

UNIT-I:

Mechatronics systems:
Elements & levels of mechatronics system, Mechatronics design process, System, Measurement systems, Control systems, Microprocessor-based controllers, Advantages and disadvantages of mechatronics systems, Introduction to electrical vehicle.

Sensors and transducers:
Types, Displacement, Position, Proximity, Velocity, Motion, Force, Acceleration, Torque, Fluid pressure, Liquid flow, Liquid level, Temperature, and light sensors.

UNIT-II:

Solid state electronic devices.
DIAC, TRIAC and LEDs. Analog signal conditioning, Operational amplifiers, Noise reduction, Filtering.

Microprocessors and micro controllers.
Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes - Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram.

UNIT-III:

Hydraulic and pneumatic actuating systems:
Fluid systems, Hydraulic systems, and pneumatic systems, Components, Control valves- pressure and direction, Electro-pneumatic, Hydro-pneumatic, Electro-hydraulic servo systems.

Mechanical and Electrical actuating systems:
Mechanical actuating systems and electrical actuating systems – basic principles and elements.

UNIT-IV:

Programmable logic controller:
Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters, and internal relays – Data handling – Selection of PLC.

Digital electronics:
Digital electronics and systems, number systems, Booleanalgebra. Digital logic control-logic gates-map.

UNIT-V:

System and interfacing and data acquisition:
Data Acquisition Systems, Analog to Digital and Digital to Analog conversions; Digital Signal Processing – data flow in DSPs, Block diagrams, Typical layouts, Interfacing motor drives, Introduction to BMS and body control.

Mechatronic system design:
Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic washing machine.

Textbooks:

1. Mechatronics Integrated Mechanical Electronics Systems, K P Ramachandran, GK Vijaya Raghavan & MS Balasundaram, WILEY India Edition.
2. Mechatronics Electronic Control Systems in Mechanical and Electrical Engineering, W. Bolton, 4th Edition, Pearson publication.
3. Mechatronics by HMT, Tata McGraw-Hill Education.

Reference Books:

1. Mechatronics, Smaili A, MradF, Oxford Higher Education, Oxford University Press.
2. Mechatronics Source Book, Newton C Braga, Thomson Publications, Chennai.
3. Mechatronics, N. Shanmugam, Anuradha Agencies Publishers
4. Mechatronics System Design, Devdasshetty, Richard, Thomson Publications, Chennai.

Weblinks:

1. https://www.electronicshub.org/different-types-sensors/
2. https://en.wikipedia.org/wiki/Solid-state_electronics
3. http://www.htl-worldwide.com/the-difference-between-pneumatic- hydraulic-and-electrical-actuators/
4. https://www.worldscientific.com/worldscibooks/10.1142/10193

ADDITIVE MANUFACTURING
(Professional Elective-III)

VI Semester **L T P C**
Course Code: 191ME6E12 **3 0 0 3**

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1: Summarize the basics of AM technologies.
CO 2: Explain about vat photo-polymerization, material jetting and binder jetting, AM technologies.
CO 3: Explain material extrusion and sheet lamination AM technologies.
CO 4: Illustrate powder bed fusion and directed energy deposition AM technologies.
CO 5: Apply the AM techniques in different industries

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12
CO1	3	-	-	-	1	1	1	-	-	-	-	-
CO2	2	-	-	-	1	1	1	-	-	-	-	-
CO3	2	-	-	-	1	1	1	-	-	-	-	-
CO4	2	-	-	-	1	1	1	-	-	-	-	-
CO5	3	-	-	-	2	1	1	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO / PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

UNIT-I:
Introduction: Basic principle, need, advantages, Challenges in Additive manufacturing (AM), AM Process chain - CAD Model - Input file formats - Generation and Conversion of STL file - File Verification and Repair - Build File Creation - Part Construction - Part Cleaning and finishing, Classification of additive manufacturing processes-Baseline approach, Raw material-based approach and ASTM classification, Materials used in additive manufacturing

UNIT-II:
VAT Photo Polymerization, Material Jetting and Binder Jetting AM technologies: Stereo lithography Apparatus (SLA), Digital Light Projection (DLP), Solid Ground Curing (SGC), Nano Particle Jetting (NPJ), Binder Jetting and Multi Jet Fusion (MJF)processes - Working Principle, Materials, Applications, Advantages and Disadvantages

UNIT-III:
Material Extrusion and Sheet Lamination AM technologies: Fused Deposition Modelling (FDM), Contour Crafting (CC), Laminated Object Manufacturing (LOM), – Working principle, Materials, Applications, Advantages and Disadvantages.

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UNIT-IV:
Powder Bed Fusion and Direct Energy Deposition: Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Electron Beam Melting (EBM), Laser Engineered Net Shaping (LENS), Wire Arc Additive Manufacturing (WAAM) - Working principle, Materials, Applications, Advantages and Disadvantages.

UNIT-V:
Additive Manufacturing - Applications:
Applications in prototyping, concept models, visualization aids, replacement parts, tooling, jigs & fixtures, moulds, casting, and end-use parts, Industrial Applications in aerospace, automobile, medical, jewellery, sports, electronics, food, construction and architectural, Case studies.

Textbooks:

1. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping and Direct Digital Manufacturing, Ian Gibson, David W. Rosen, Brent Stucker, Springer, 2nd Edition.
2. 3D Printing and Additive Manufacturing: Principles and Applications, Chua C.K., and Leong K.F., World Scientific publications, 4th Edition.

Reference Books:

1. Additive Manufacturing, Amit Bandyopadhyay, Sushmita Bose, CRC Press, 1st Edition.
2. Rapid Prototyping & Manufacturing, Paul F. Jacobs, ASME Press, 1st Edition.
3. Additive Manufacturing of Metals: From Fundamental Technology to Rocket Nozzles, Medical Implants and Custom Jewellery, John O. Milewski, Springer, 1st Edition.
4. Additive Manufacturing: Design, Methods and Processes, Steinar Western Killi, Pan Stanford, 1st Edition.
5. Additive Manufacturing of Metals: The Technology, Materials, Design and Production, Yang, L., Hsu, K., Baughman, B., Godfrey, D., Medina, F., Menon, M., Wiener, S., Springer, 1st Edition.

Weblinks:

1. https://www.reprap.org
2. https://www.thingiverse.com
3. https://www.3dprintingindustry.com
4. https://www.all3dp.com
5. https://additivemanufacturing.com

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Syllabus revision Index (2021-22)

S. No	Name of the course	Percentage of syllabus change
1	Theory of Machines-I	20
2	Fluid Engineering	40
3	Mechanical Vibrations	25
4	Mechatronics	20
5	Additive Manufacturing	40

Program Coordinator

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Department of Mechanical Engineering

1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	**Kinematics of Machinery**	**Theory of Machines-I**
Course Code	**191ME4T08**	**201ME4T04**
Syllabus	UNIT I: **Classification of mechanisms-** Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider crank chains-Limit positions-Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line generators-Universal Joint- Rocker mechanisms.	**UNIT I:** **Classification of Mechanisms-** Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain -Limit positions- Mechanical advantage-Description of some common mechanisms- Crank and Slotted Lever mechanism, Quick Return Motion mechanism, Davis and Ackermann Steering gear mechanisms, Hooke's joint.
	UNIT II: **Kinematics:** Plane motion of body: Instantaneous centre of rotation, centrode and axode - relative motion between two bodies – Kennedy's three centres in line theorem – Graphical determination of instantaneous centre for simple bar four bar and single slider crank chain mechanisms and determination of angular velocity of points and links. **Motion of a link in machine** - Determination of Displacement, velocity and acceleration for a Simple Four Bar Mechanism, Single slider crank chain mechanism, Double slider crank chain mechanism (Whitworth Quick Return Motion mechanisms).	**UNIT II:** **Kinematics:** Plane motion of body: Instantaneous centre of rotation, centrode and axode - Relative motion between two bodies – Kennedy's Theorem – Graphical determination of instantaneous centre for Four bar and Single Slider Crank chain mechanisms, Determination of Angular Velocity of points and links. **Motion of a Link in Machine** - Determination of Displacement, Velocity and Acceleration for a Four Bar Mechanism, Single Slider Crank chain mechanism, Double Slider Crank chain mechanism
	UNIT III: **Cams:** Definition and classification of cams and followers - their uses - Terminology - Types of follower motion: Uniform velocity, Simple harmonic motion and uniform acceleration and retardation, Cycloidal	**UNIT III:** **Cams:** Definition and classification of Cams and Followers - Terminology - Types of follower motion: Uniform velocity, Simple harmonic motion and Uniform Acceleration and Retardation, Cycloidal

	motion for Knife edge, Flat face and Roller follower and offset follower.	motion for Knife edge, Flat face and Roller follower and offset follower.
	UNIT-IV: **Power Transmission:** Introduction –Modes of power transmission applications. **Gears and Gear Trains:** Classification, Terminology, Law of Gearing, path of contact, arc of contact. Interferences, methods of avoiding interferences. Simple gear train, compound gear train, reverted gear train, epicyclical gear train and Differential.	**UNIT-IV:** **Power Transmission:** Introduction –Modes of Power Transmission applications. **Gears and Gear Trains:** Classification, Terminology, Law of Gearing, Path of contact, Arc of contact. Interference, Methods of avoiding interferences. Simple gear train, Compound gear train, reverted gear train, epicyclic gear train and Differential. Table method to find velocity of components of a gear train.
	UNIT-V: **Practical Applications:** Design and fabrication of any one of the following mechanisms: Whitworth Quick Return Mechanism, Oscillating Cylinder Mechanism, Elliptical Trammel, Manual/Motorized Scotch Yoke Mechanism Piston, Bench Tapping Machine, Mini Conveyor using Geneva Mechanism, Mini Hacksaw Powered by Beam Engine.	**UNIT-V:** **Turning Moment Diagrams:** Static and dynamic force analysis of planar mechanisms, Dynamic force analysis of slider crank mechanism, Inertia Torque, Angular Velocity and Acceleration of connecting rod, Crank Effort and Turning Moment Diagrams – Fluctuation of energy – Fly Wheel design.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Fluid Mechanics & Hydraulic Machinery	Fluid Engineering
Course Code	171ES3T14	191ME5E03
Syllabus	**UNIT-I:** **Fluid Statics:** Dimensions and units: Physical properties of fluids–Mass, Density, Specific weight, Specific volume, Specific gravity, Viscosity, Surface tension, Vapor pressure and their influence on fluid motion. Atmospheric pressure, Gauge pressure and vacuum pressure, Measurement of pressure Piezometers, U-tube and differential manometers. **Buoyancy and Flotation:** Meta center, Stability of floating body. Submerged bodies. Calculation of metacentric height. Stability analysis and applications. **Fluid Kinematics:** Streamline, Path line and streak lines and stream tubes, Classification of flows ideal fluid and real fluid–steady and unsteady flows, Uniform and non-uniform flows, Laminar and turbulent flows, Rotational and irrational flows, Equation of continuity for one-dimensional flows.	**UNIT-I:** **Compressors:** Classification Positive displacement and roto dynamic machinery Power producing and power absorbing machines, Fan, Blower and Compressor Positive displacement and dynamic types Reciprocating and rotary types. **Reciprocating Compressor:** Principle of operation, Work required, Isothermal efficiency, Volumetric efficiency and effect of clearance, Multi stage compression, Under cooling, Saving of work, Minimum work condition for two stage compression.

	UNIT-II: **Fluid Dynamics:** Various forces acting on a fluid element- Euler's and Bernoulli's equation for flow along a stream line, Momentum equation and its applications for pipe bend problem. **Closed Conduit Flow:** Reynolds number, Reynolds experiment–"Darcy–Welsbach" equation–Minor losses in pipes, Pipes in series and pipes in parallel, Total energy line, Hydraulic gradient line.	**UNIT-II:** **Rotary Compressor (Positive Displacement Type):** Roots Blower, Vane sealed compressor, Lysholm compressor, Mechanical details and Principle of working Efficiency considerations. **Centrifugal Compressors:** Mechanical details and principle of operation Velocity and pressure variation. Energy transfer-Impeller blade shape-losses, Slip factor, Power input factor, Pressure coefficient and adiabatic coefficient Velocity diagrams Power. **Axial Flow Compressors:** Mechanical details and principle of operation Velocity triangles and energy transfer per stage degree of reaction, Work done factor - Isentropic efficiency- Pressure rise calculations Polytropic efficiency.
	UNIT-III: **Boundary Layer Theory:** Introduction, Momentum Integral equation, Displacement, Momentum and energy thickness. **Dimensional Analysis:** Dimensionless numbers. **Impact of Jet on Vanes:** Hydrodynamic force on jets on stationary and moving flat, Inclined and curved vanes, Jet striking centrally and at tip, Velocity diagrams, Work done and efficiency, Flow over radial vanes.	**UNIT-III:** **Hydraulic Machines: Turbines** Velocity Triangles and Work done for a Pelton Wheel, Design of Pelton Wheel, Radial Flow reaction Turbines- Inward & Outward; Degree of reaction; Francis Turbine; Axial Flow Reaction Turbines; Draft Tube; Specific Speed; Unit Quantities; Characteristic curves of Hydraulic turbines and governing of turbines.
	UNIT-IV: **Hydraulic Turbines:** Classification of turbines–Impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine–Working principles, Work done, Efficiencies, Hydraulic design, Draft tube theory, Functions and efficiency.	**UNIT-IV:** **Centrifugal Pumps:** Work done by the Centrifugal Pump; Heads and efficiencies; Minimum speed to start, Multistage, Specific speed, Model testing; Priming; Characteristic curves; Cavitation; Maximum suction Lift; Net positive Suction Head.

	Performance of Hydraulic Turbines: Geometric similarity, Unit and specific quantities, Characteristic curves, Governing of turbines, selection of type of turbines, Cavitation's, Surge tank, Water hammer.	
	UNIT -V: **Centrifugal and Reciprocating Pumps:** Classification, working of centrifugal pump, Work done– Manometric head–Losses and efficiencies– Specific speed pumps in series and parallel, Performance characteristic curves, NPSH. Working of Reciprocating pumps, Discharge, slip, Percentage slip and Indication diagrams.	**UNIT-V:** **Reciprocating Pumps:** Discharge, Work done and power required calculations; Slip; Variation of velocity and acceleration in suction and delivery pipes; Effect of variation of velocity on friction in the suction and delivery pipes; Indicator diagram; Air vessels and Comparison of Centrifugal and Reciprocating Pumps.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Mechanical Vibrations	Mechanical Vibrations
Course Code	171ME5E02	191ME5E04
Syllabus	**UNIT-I:** **Introduction:** Simple harmonic motion, Terminology, Newton's Law, D'Alembert's Principle, Resonance, Introduction to mechanism of damping, Damped and Undamped oscillations, Degrees of freedom, Various mechanisms of damping, Equivalent viscous damping.	**UNIT-I:** **Single degree of Freedom systems:** Undamped and damped free vibrations: forced vibrations ; coulomb damping; Response to harmonic excitation; rotating unbalance and support excitation, Vibration isolation and transmissibility.
	UNIT-II: **Single Degree of Freedom Systems**: Undamped and damped free vibrations, Forced vibrations, Coulomb damping, Response to harmonic excitation, Rotating unbalance and support excitation, Vibration isolation and transmissibility, Vibrometers, Velocity meters & Accelerometers.	**UNIT-II:** **Vibration Measurement:** Vibrometers, velocity meters & accelerometers Two degree of freedom systems: Principal modes – undamped and damped free and forced vibrations; undamped vibration absorbers.
	UNIT-III: **Two Degree & Multi Degree Freedom Systems:** Principal modes, other cases, Combined rectilinear and angular models, System with damping, Vibration absorbers, Undamped forced vibrations with harmonic excitation, Multi degree freedom with exact analysis.	**UNIT-III:** **Multi degree of freedom systems:** Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi – rotor systems and geared systems; Discrete Time systems.
	UNIT-IV: **Numerical Methods:** Rayliegh's, Stodola's, Matrix iteration, Rayleigh-Ritz Method and Holzer's methods	**UNIT-IV:** **Numerical Methods:** Rayleigh's, stodola's, Matrix iteration, Rayleigh-Ritz Method and Holzer's methods

	UNIT-V: **Application of Concepts:** Critical speeds of shafts with and without damping, Single and multi-disc, Cantilever shaft with large heavy disc, Free vibration of strings – Longitudinal oscillations of bars-Transverse vibrations of beams-Torsional vibrations of shafts, Secondary critical speed. Introduction to Condition Monitoring, FFD Analyzer.	**UNIT-V:** **Application of concepts:** Free vibration of strings – longitudinal oscillations of barstransverse vibrations of beams- Torsional vibrations of shafts. Critical speeds without and with damping, secondary critical speed.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Mechatronics	Mechatronics
Course Code	171ME7T17	191ME6E08
Syllabus	**UNIT-I:** **Mechatronics systems:** Elements & levels of mechatronics system, Mechatronics design process, System, Measurement systems, Control systems, Microprocessor-based controllers, Advantages and disadvantages of mechatronics systems. Sensors and transducers: Types, Displacement, Position, Proximity, Velocity, Motion, Force, Acceleration, Torque, Fluid pressure, Liquid flow, Liquid level, Temperature and light sensors.	**UNIT-I:** **Mechatronics systems:** Elements & levels of mechatronics system, Mechatronics design process, System, Measurement systems, Control systems, Microprocessor-based controllers, Advantages and disadvantages of mechatronics systems, Introduction to electrical vehicle. **Sensors and Transducers:** Types, Displacement, Position, Proximity, Velocity, Motion, Force, Acceleration, Torque, Fluid pressure, Liquid flow, Liquid level, Temperature, and light sensors.
	UNIT-II: **Solid state and digital electronic devices:** DIAC, TRIAC and LEDs. Analog signal conditioning, Operational amplifiers, Noise reduction, Filtering, Digital electronics and systems, Digital logic control, microprocessors and micro controllers.	**UNIT-II:** **Solid State Electronic Devices:** DIAC, TRIAC and LEDs. Analog signal conditioning, Operational amplifiers, Noise reduction, Filtering. Microprocessors and micro controllers. Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes -Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram.
	UNIT-III: **Hydraulic and pneumatic actuating systems:** Fluid systems, Hydraulic systems, and pneumatic systems, Components, Control valves, Electro-pneumatic, Hydro-pneumatic, Electro-hydraulic servo systems. Mechanical and Electrical actuating systems: Mechanical	**UNIT-III:** **Hydraulic and pneumatic actuating systems:** Fluid systems, Hydraulic systems, and pneumatic systems, Components, Control valves- pressure and direction, Electro-pneumatic, Hydro-pneumatic, Electro-hydraulic servo systems. Mechanical and Electrical actuating systems:

	actuating systems and electrical actuating systems – basic principles and elements.	Mechanical actuating systems and electrical actuating systems – basic principles and elements.
	UNIT-IV: **Programmable logic controller:** Basic Structure – Memory - Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling – Analogs Input / Output – Selection of a PLC – PLC Applications	**UNIT-IV:** **Programmable logic controller:** Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters, and internal relays – Data handling – Selection of PLC. Digital electronics: Digital electronics and systems, number systems, Boolean algebra. Digital logic control-logic gates-map.
	UNIT-V: **Dynamic models and analogies:** System response. Process Controllers – Digital Controllers, Programmable Logic Controllers, Design of mechatronics systems & future trends. System and interfacing and data acquisition: Data Acquisition Systems, Analog to Digital and Digital to Analog conversions; Digital Signal Processing – data flow in DSPs, Block diagrams, Typical layouts, Interfacing motor drives.	**UNIT-V:** **System and interfacing and data acquisition:** Data Acquisition Systems, Analog to Digital and Digital to Analog conversions; Digital Signal Processing – data flow in DSPs, Block diagrams, Typical layouts, Interfacing motor drives, Introduction to BMS and body control. **Mechatronic system design:** Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic washing machine.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Additive Manufacturing	Additive Manufacturing
Course Code	171ME5E03	191ME6E12
Syllabus	**UNIT-I:** **Introduction:** Prototyping fundamentals, historical development, fundamentals of rapid prototyping, advantages and limitations of rapid prototyping, commonly used terms, classification of RP process. Liquid Based – Rapid Prototyping Systems: Stereo lithography Apparatus (SLA): models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. Solid Ground Curing (SGC): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.	**UNIT-I:** **Introduction:** Basic principle, need, advantages, Challenges in Additive manufacturing (AM), AM Process chain - CAD Model - Input file formats - Generation and Conversion of STL file - File Verification and Repair - Build File Creation - Part Construction - Part Cleaning and finishing, Classification of additive manufacturing processes-Baseline approach, Raw material-based approach and ASTM classification, Materials used in additive manufacturing
	UNIT-II:. **Solid – Based Rapid Prototyping Systems:** Laminated object manufacturing (LOM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Fused deposition modeling (FDM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies.	**UNIT-II:** **VAT Photo Polymerization, Material Jetting and Binder Jetting AM technologies:** Stereo lithography Apparatus (SLA), Digital Light Projection (DLP), Solid Ground Curing (SGC), Nano Particle Jetting (NPJ), Binder Jetting and Multi Jet Fusion (MJF) processes - Working Principle, Materials, Applications, Advantages and Disadvantages
	UNIT-III: **Power Based Rapid Prototyping Systems:** Selective laser sintering (SLS): models and specifications, process, working principle, applications,	**UNIT-III:** **Material Extrusion and Sheet Lamination AM technologies:** Fused Deposition Modelling (FDM), Contour Crafting (CC), Laminated Object Manufacturing (LOM), –

	advantages and disadvantages, case studies. Three dimensional printing (3DP): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.	Working principle, Materials, Applications, Advantages and Disadvantages.
	UNIT-IV: **Rapid Tooling:** Introduction to rapid tooling (RT), conventional tooling vs RT, Need for RT. rapid tooling classification: indirect rapid tooling methods: spray metal deposition, RTV epoxy tools, Ceramic tools, investment casting, spin casting, die casting, sand casting, 3D Keltool process. Direct rapid tooling: direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.	**UNIT-IV:** **Powder Bed Fusion and Direct Energy Deposition:** Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Electron Beam Melting (EBM), Laser Engineered Net Shaping (LENS), Wire Arc Additive Manufacturing (WAAM) - Working principle, Materials, Applications, Advantages and Disadvantages.
	UNIT-V: **Rapid Prototyping Data Formats:** STL file format, problems and repairs. Applications: Application in engineering, analysis and planning, aerospace industry, automotive industry, jewelry industry, coin industry, GIS application, arts and architecture. RP medical and bioengineering applications: planning and simulation of complex surgery, customized implants & prosthesis, design and production of medical devices, forensic science and anthropology, visualization of bimolecular.	**UNIT-V:.** **Additive Manufacturing - Applications:** Applications in prototyping, concept models, visualization aids, replacement parts, tooling, jigs & fixtures, moulds, casting, and end-use parts, Industrial Applications in aerospace, automobile, medical, jewellery, sports, electronics, food, construction and architectural, Case studies.

Course Coordinator

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Program Name : B.Tech. in Electronics and Communication Engineering

Syllabus Revision for the Academic Year 2021-2022

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
1	I	201HS1T01	Communicative English	0
2	I	201BS1T01	Differential Equations and Linear Algebra	0
3	I	201BS1T04	Engineering Chemistry	0
4	I	201ES1T02	Programming for Problem Solving using C	0
5	I	201ES1I01	Engineering Graphics and Design	0
6	I	201HS1L01	Communicative English Lab	0
7	I	201BS1L03	Engineering Chemistry Lab	0
8	I	201ES1L02	Programming for Problem Solving using C Lab	0
9	I	201MC1T01	Environmental Science	0
10	II	201BS2T06	Transform Techniques	0
11	II	201BS2T09	Applied Physics	0
12	II	201ES2I03	Object Oriented Programming through JAVA	0
13	II	201ES2T10	Basic Electrical Engineering	0
14	II	201ES2T14	Network Analysis	0
15	II	201ES2L08	Electronics Engineering Workshop	0
16	II	201BS2L04	Applied Physics Lab	0
17	II	201ES2L13	Basic Electrical Engineering Lab	0
18	II	201MC2L01	Professional Communication Skills Lab	0
19	II	201MC2T02	Constitution of India	0
20	III	201BS3T10	Numerical Methods & Vector Calculus	0
21	III	201EC3T01	Electronic Devices and Circuits	0
22	III	201EC3T02	Signals and Systems	0
23	III	201EC3T03	Digital Electronics and Logic Design	0
24	III	201EC3T04	Random Variables and Stochastic Processes	0
25	III	201EC3L01	Electronic Devices and Circuits Lab	0
26	III	201EC3L02	Signals and Systems Lab	100
27	III	201EC3L03	Digital Electronics and Logic Design Lab	14.2

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
28	III	201SO3L04	Skill Oriented Course-I:Python Programming	100
29	III	201MC3T03	Biology for Engineers	0
30	IV	201ES4T19	Linear Control Systems	0
31	IV	201EC4T05	Electronic Circuit Analysis	0
32	IV	201EC4T06	Integrated Circuits and Applications	0
33	IV	201EC4T07	Analog Communications	5
34	IV	201HS4T03	Managerial Economics and Financial Analysis	0
35	IV	201EC4L04	Electronic Circuit Analysis Lab	0
36	IV	201EC4L05	Integrated Circuits and Applications Lab	25
37	IV	201EC4L06	Analog Communications Lab	0
38	IV	201SC4L16	Skill Oriented Course-II: a) PCB Designing	100
39	IV	201SC4L17	Skill Oriented Course-II: b)Applications of Python Programming	100
40	IV	201MC4T04	Essence of Indian Traditional Knowledge	0
41	V	191EC5T08	Integrated Circuits and applications	0
42	V	191EC5T09	Digital Communications	5
43	V	191EC5T10	Antennas and Wave Propagation	5
44	V	191EC5T11	Computer Networks	0
45	V	191EC5E03	Electromagnetic Interference & Compatibility	100
46	V	191EC5E01	Computer System Architecture	20
47	V	191EC5E02	Digital System Design-I	100
48	V	191EC5E04	Python Programming	100
49	V	191CE5O01	Basic Concrete Technology	0
50	V	191EE5O01	Electrical Safety	100
51	V	191EE5O02	Electrical Materials	100
52	V	191EE5O03	Renewable Energy Sources	100
53	V	191ME5O02	Fundamentals of Mechanical Engineering	100
54	V	191ME5O03	Supply Chain Management	100
55	V	191ME5O04	3D Printing	100
56	V	191ME5O05	Entrepreneurship Development and Incubation	100
57	V	191CS5O02	Object Oriented Programming through C++	100
58	V	191CS5O03	Java Programming	16.6
59	V	191CS5O04	R Programming	100
60	V	191IT5O01	Data Base Management Systems	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
61	V	191IT5O02	Computer Graphics	100
62	V	191MI5O01	Overview of Mining	100
63	V	191PT5O01	Process Intensification in Petroleum Industry	100
64	V	191PT5O02	Fundamentals of Petroleum Industry	100
65	V	191AG5O01	Basic Crop Production Practices	100
66	V	191EC5L05	Integrated Circuits and applications Lab	14.28
67	V	191EC5L06	Digital Communications Lab	0
68	V	191HS5T06	Employability Skills – III	0
69	V	191PR5P02	Socially Relevant Project	100
70	VI	191EC6T12	Internet of Things	10
71	VI	191EC6T13	VLSI Design	20
72	VI	191EC6T14	Digital Signal Processing	5
73	VI	191EC6E07	Information Theory and Coding	30
74	VI	191EC6E06	Embedded Systems	0
75	VI	191EC6E05	Digital System Design-II	100
76	VI	191EC6E08	Soft Computing Techniques	100
77	VI	191EC6E11	Radar Systems	5
78	VI	191EC6E10	Embedded C	100
79	VI	191EC6E09	Design for Testability	100
80	VI	191EC6E12	Signal Transform Techniques	100
81	VI	191CE6O02	Disaster Management	0
82	VI	191EE6O04	Energy Audit and Conservation Management	100
83	VI	191EE6O05	Non Conventional Energy resources	100
84	VI	191ME6O06	Solar Energy Utilisation	100
85	VI	191ME6O07	Basic Thermodynamics and Heat Transfer	100
86	VI	191ME6O08	Introduction to Hydraulics and Pneumatics	100
87	VI	191ME6O09	3D Printing	100
88	VI	191ME6O06	Robotics	0
89	VI	191ME6O09	Management Science	0
90	VI	191ME6O12	Entrepreneurship Development and Incubation	100
91	VI	191ME6O07	Biomedical Instrumentation	100
92	VI	191CS6O05	Python Programming	100
93	VI	191CS6O06	Operating Systems	16.6

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
94	VI	191CS6O07	Web Technologies	0
95	VI	191CS6O08	Cyber Security	100
96	VI	191CS6O09	AR / VR	100
97	VI	191IT6O03	Computer Organization	100
98	VI	191IT6O04	AI Tools & Techniques	100
99	VI	191IT6O05	Robotic Process Automation	100
100	VI	191MI6O02	Industrial Safety Practices	100
101	VI	191MI6O03	Electrical Equipment's in Mines	100
102	VI	191PT6O03	Unconventional Hydrocarbon Resources	100
103	VI	191PT6O04	Asset Management	100
104	VI	191AG6O02	Weather forecast in Agriculture	100
105	VI	191AG6O03	Bio-energy systems design and applications	100
106	VI	191EC6L08	VLSI Lab	50
107	VI	191EC6L07	Internet of Things Lab	100
108	VI	191HS6T07	Employability Skills – IV	0
109	VII	171EC7T16	Microwave Engineering	0
110	VII	171EC7T17	Digital Image Processing	0
111	VII	171EC7T18	Electronic Measurements And Instrumentation	0
112	VII	171EC7T19	Optical Communications	0
113	VII	171EC7E10	Digital Signal Processors	0
114	VII	171EC7E11	Embedded Systems	0
115	VII	171EC7E12	Cellular and Mobile Communications	0
116	VII	171EC7E13	Analog IC Design	0
117	VII	171EC7E14	Cryptography and Network Security	0
118	VII	171EC7E15	Radar Systems	0
119	VII	171EC7L10	Microwave Engineering and Optical Communications Lab	0
120	VII	171EC7L11	Digital Signal and Image Processing Lab	0
121	VII	171EC7P01	Industry Oriented (Internship) Minor Project	0
122	VIII	171EC8E16	Mixed Signal IC Design	0
123	VIII	171EC8E17	Wireless Sensors and Networks	0
124	VIII	171EC8E18	Satellite Communications	0
125	VIII	171EC8O01	Basic Concrete Technology	0
126	VIII	171CE8O04	Waste Water Management	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
127	VIII	171EE8O05	Robotics	0
128	VIII	171EC8O02	Disaster Management	0
129	VIII	171EE8O07	Internet of Things	0
130	VIII	171EC8O03	Neural Networks	0
131	VIII	171CE8O03	Alternative Energy Sources	0
132	VIII	171CE8O02	Database Management Systems	0
133	VIII	171EC8O04	Web Technologies	0
134	VIII	171CE8O06	Green Fuel Technologies	0
135	VIII	171EC8P02	Major Project	0

Total number of courses in the academic year 2021-2022	= 135
Number of courses having revision in syllabus content >/= 20% in the academic year 2021-2022	= 49
Percentage of syllabus revision carried out in the academic year 2021-2022 = (49/135)*100	= 36.29%

A Karl

Program Coordinator

G. Saidood

Head of the Department

Head of the Department
Department of E.C.E.
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PROGRAM STRUCTURE

I SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201HS1T01	Communicative English	HSMC	Theory	3	0	0	3	3
201BS1T01	Differential Equations and Linear Algebra	BSC	Theory	3	0	0	3	3
201BS1T04	Engineering Chemistry	BSC	Theory	3	0	0	3	3
201ES1T02	Programming for Problem Solving using C	ESC	Theory	3	0	0	3	3
201ES1I01	Engineering Graphics and Design	ESC	Integrated	2	0	2	4	3
201HS1L01	Communicative English Lab	HSMC	Lab	0	0	3	3	1.5
201BS1L03	Engineering Chemistry Lab	BSC	Lab	0	0	3	3	1.5
201ES1L02	Programming for Problem Solving using C Lab	ESC	Lab	0	0	3	3	1.5
201MC1T01	Environmental Science	MC	Theory	2	0	0	2	0
			TOTAL	16	0	11	27	19.5

II SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS2T06	Transform Techniques	BSC	Theory	3	0	0	3	3
201BS2T09	Applied Physics	BSC	Theory	3	0	0	3	3
201ES2I03	Object Oriented Programming through JAVA	ESC	Integrated	2	0	2	4	3
201ES2T10	Basic Electrical Engineering	ESC	Theory	3	0	0	3	3
201ES2T14	Network Analysis	ESC	Theory	3	0	0	3	3
201ES2L08	Electronics Engineering Workshop	ESC	Lab	0	0	3	3	1.5
201BS2L04	Applied Physics Lab	BSC	Lab	0	0	3	3	1.5
201ES2L13	Basic Electrical Engineering Lab	ESC	Lab	0	0	3	3	1.5
201MC2L01	Professional Communication Skills Lab	MC	Lab	0	0	3	3	0
201MC2T02	Constitution of India	MC	Theory	2	0	0	2	0
			TOTAL	16	0	16	0	19.5

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III SEMESTER								
Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS3T10	Numerical Methods & Vector Calculus	BSC	Theory	3	0	0	3	3
201EC3T01	Electronic Devices and Circuits	PCC	Theory	3	0	0	3	3
201EC3T02	Signals and Systems	PCC	Theory	3	0	0	3	3
201EC3T03	Digital Electronics and Logic Design	PCC	Theory	3	0	0	3	3
201EC3T04	Random Variables and Stochastic Processes	PCC	Theory	3	0	0	3	3
201EC3L01	Electronic Devices and Circuits Lab	PCC	Lab	0	0	3	3	1.5
201EC3L02	Signals and Systems Lab	PCC	Lab	0	0	3	3	1.5
201EC3L03	Digital Electronics and Logic Design Lab	PCC	Lab	0	0	3	3	1.5
201SC3L04	**Skill Oriented Course - I** Python Programming	SC	Lab	0	0	4	4	2
201MC3T03	Biology for Engineers	MC	Theory	2	0	0	2	0.
			TOTAL	**17**	**0**	**13**	**30**	**21.5**

IV SEMESTER								
Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201ES4T19	Linear Control Systems	ESC	Theory	3	0	0	3	3
201EC4T05	Electronic Circuit Analysis	PCC	Theory	3	0	0	3	3
201EC4T06	Integrated Circuits and Applications	PCC	Theory	3	0	0	3	3
201EC4T07	Analog Communications	PCC	Theory	3	0	0	3	3
201HS4T03	Managerial Economics and Financial Analysis	HSMC	Theory	3	0	0	3	3
201EC4L04	Electronic Circuit Ánalysis Lab	PCC	Lab	0	0	3	3	1.5
201EC4L05	Integrated Circuits and Applications Lab	PCC	Lab	0	0	3	3	1.5
201EC4L06	Analog Communications Lab	PCC	Lab	0	0	3	3	1.5
201SC4L16 201SC4L17	**Skill Oriented Course-II** a) PCB Designing b) Applications of Python Programming	SC	Lab	0	0	4	4	2
201MC4T04	Essence of Indian Traditional Knowledge	MC	Theory	2	0	0	2	0
			TOTAL	**17**	**0**	**13**	**30**	**21.5**

BSC: Basic Sciences Courses; HSMC: Humanities and Social Sciences including Management Courses; ESC: Engineering Sciences Courses; PCC: Professional Core Courses; SC: Skill Oriented Course; PEC: Professional Elective Courses; OEC: Open Elective Courses; MC: Mandatory Courses; PROJ: Project.

Q. Seidns

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HONORS DEGREE

Specialization: Communication Systems and Signal Processing

S.No.	Course Code	COURSE TITLE	L	T	P	C	SEMESTER
1.	201EC4H01	Machine Learning	3	1	0	4	IV
2.	201EC5H04	Telecom Switching Systems and Networks	3	1	0	4	V
3.	201EC6H07	Wireless Broadband Communications	3	1	0	4	VI
4.	201EC7H10	Adaptive Signal Processing	3	1	0	4	VII

Specialization: Embedded Systems

S.No.	Course Code	COURSE TITLE	L	T	P	C	SEMESTER
1.	201EC4H02	Computer Architecture and Organization	3	1	0	4	IV
2.	201EC5H05	Robotics	3	1	0	4	V
3.	201EC6H08	Advanced Micro Controllers	3	1	0	4	VI
4.	201EC7H11	Real-Time Operating Systems	3	1	0	4	VII

Specialization: VLSI Design

S.No.	Course Code	COURSE TITLE	L	T	P	C	SEMESTER
1.	201EC4H03	Digital IC Applications	3	1	0	4	IV
2.	201EC5H06	System Design through Verilog	3	1	0	4	V
3.	201EC6H09	Scripting Languages: PERL	3	1	0	4	VI
4.	201EC7H12	Advanced VLSI	3	1	0	4	VII

MINOR PROGRAM

S.No.	Course Code	COURSE TITLE	L	T	P	C	SEMESTER
1.	201EC4M01	Circuit Theory	3	1	0	4	IV
2.	201EC4M02	Basic Electronics	3	1	0	4	IV
3.	201EC4M03	Digital Electronics	3	1	0	4	IV
4.	201EC5M04	Fundaments of SignalProcessing	3	1	0	4	V
5.	201EC5M05	Analog and Digital IC Applications	3	1	0	4	V
6.	201EC6M06	Micro Controllers	3	1	0	4	VI
7.	201EC6M07	Principles of Communication	3	1	0	4	VI
8.	201EC7M08	Internet of Things	3	1	0	4	VII
9.	201EC7M09	Basics of VLSI Design	3	1	0	4	VII
10.	201EC7M10	Wireless Networks	3	1	0	4	VII

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V SEMESTER

Course Code	Course Title	Course Component	Total Number of contact hours Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	Credits (C)
191EC5T08	Integrated Circuits and applications	PCC	3	0	0	3	3
191EC5T09	Digital Communications	PCC	3	0	0	3	3
191EC5T10	Antennas and Wave Propagation	PCC	3	0	0	3	3
191EC5T11	Computer Networks	PCC	2	0	0	2	2
----	Professional Elective-I	PEC	3	0	0	3	3
----	Open Elective –I	OEC	3	0	0	3	3
191EC5L05	Integrated Circuits and applications Lab	PCC	0	0	3	3	1.5
191EC5L06	Digital Communications Lab	PCC	0	0	2	2	1
191HS5T06	Employability Skills – III	HSMC	0	0	2	2	1
191PR5P02	Socially Relevant Project	PROJ	0	0	2	2	1
191MC5A08	Intellectual Property Rights and Patents	MC	2	0	0	2	0
		TOTAL	17	0	9	26	21.5

VI SEMESTER

Course Code	Course Title	Course Component	Total Number of contact hours Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	Credits (C)
191EC6T12	Internet of Things	PCC	3	0	0	3	3
191EC6T13	VLSI Design	PCC	3	0	0	3	3
191EC6T14	Digital Signal Processing	PCC	3	0	0	3	3
----	Professional Elective –II	PEC	3	0	0	3	3
----	Professional Elective –III	PEC	3	0	0	3	3
----	Open Elective-II	OEC	3	0	0	3	3
191EC6L08	VLSI Lab	PCC	0	0	3	3	1.5
191EC6L07	Internet of Things Lab	PCC	0	0	3	3	1.5
191HS6T07	Employability Skills – IV	HSMC	0	0	2	2	1
191MC6A09	Professional Ethics and Human Values	MC	2	0	0	2	0
		TOTAL	18	0	8	26	22

VII SEMESTER

Course Code	Course Title	Course Component	Total Number of contact hours Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	Credits (C)
191EC7T15	Microwave and Optical Communications	PCC	3	0	0	3	3
191EC7T16	Digital Image and Video Processing	PCC	3	0	0	3	3
----	Professional Elective -IV	PEC	3	0	0	3	3
----	Professional Elective -V	PEC	3	0	0	3	3
----	Open Elective -III	OEC	3	0	0	3	3
191EC7P03	Internship	PROJ	0	0	4	4	2
191EC7L09	Digital Signal and Image Processing Lab	PCC	0	0	3	3	1.5

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191EC7L10	Microwave and Optical Communications Lab	PCC	0	0	3	3	1.5
191EC7P04	Project Part 1	PROJ	0	0	4	4	2
		TOTAL	15	0	14	29	22

VIII SEMESTER

Course Code	Course Title	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
----	Professional Elective-VI (MOOCs)	PEC	-	-	-	-	3
----	Open Elective -IV (MOOCs)	OEC	-	-	-	-	3
191EC8P05	Project Part 2	PROJ	0	0	14	14	7
		TOTAL	0	0	14	14	13

BSC: Basic Sciences Courses; HSMC: Humanities and Social Sciences including Management Courses; ESC: Engineering Sciences Courses; PCC: Professional Core Courses; PEC: Professional Elective Courses; OEC: Open Elective Courses; SSC: Self Study Course; MC: Mandatory Courses; PROJ: Project.

Courses to be offered as Professional Electives by ECE Department by Specialization

Track Title / Specialization	PEC-I (V Semester)	PEC-II (VI Semester)	PEC-III (VI Semester)	PEC-IV (VII Semester)	PEC-V (VII Semester)
Microwave & Communication Systems	Electromagnetic Interference & Compatibility 191EC5E03	Information Theory and Coding 191EC6E07	Radar Systems 191EC6E11	Satellite Communications 191EC7E16	Cellular and Mobile Communications 191EC7E17
Embedded Systems	Computer System Architecture 191EC5E01	Embedded Systems 191EC6E06	Embedded C 191EC6E10	Real Time Operating Systems 191EC7E15	SoC Architectures 191EC7E20
VLSI	Digital System Design-I 191EC5E02	Digital System Design-II 191EC6E05	Design for Testability 191EC6E09	CMOS Digital IC Design 191EC7E13	Low Power VLSI Design 191EC7E18
Signal Processing	Python Programming 191EC5E04	Soft Computing Techniques 191EC6E08	Signal Transform Techniques 191EC6E12	Digital Signal Processors & Architectures 191EC7E14	Pattern Recognition 191EC7E19

Professional Elective – VI (VIII Semester) (MOOCS)		
S. No	**Track Title / Specialization**	**Name of the Course**
1.	Microwave & Communication Systems	Wireless Communications 191EC8E24
2.	Embedded Systems	Sensors and Actuators 191EC8E23
3.	VLSI	Micro Electronic Devices to Circuits 191EC8E22
4.	Signal Processing	Introduction to Computer Vision 191EC8E21

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OPEN ELECTIVE - I (V Semester)

S. No	Course Code	Course Name	Not Offered to Branches	Offered By Department
1	191CE5O01	Basic Concrete Technology	CE, EEE	CE
2	191EE5O01	Electrical Safety	EEE	EEE
3	191EE5O02	Electrical Materials	EEE	EEE
4	191EE5O03	Basic Electrical Measurements	EEE, ECE	EEE
5	191EE5O03	Renewable Energy Sources	CE, EEE, ME, Ag. E	ME
6	191ME5O02	Fundamentals of Mechanical Engineering	ME	ME
7	191ME5O03	Supply Chain Management	ME	ME
8	191ME5O04	3D Printing	ME	ME
9	191ME5O05	Entrepreneurship Development and Incubation		ME
10	191EC5O01	Signals & Systems	EEE, ECE	ECE
11	191EC5O02	Digital Electronics and Logic Design	EEE, ECE, CSE, IT	ECE
12	191EC5O03	Semi conductor devices	EEE, ECE	ECE
13	191CS5O01	Data Structures	EEE, ECE, CSE, IT	CSE
14	191CS5O02	Object Oriented Programming through C++	CSE, IT	CSE
15	191CS5O03	Java Programming	CSE, IT	CSE
16	191CS5O04	R Programming		CSE
17	191IT5O01	Data Base Management Systems	CSE, IT	IT
18	191IT5O02	Computer Graphics	CSE, IT	IT
19	191MI5O01	Overview of Mining	Min.E	Min.E
20	191PT5O01	Process Intensification in Petroleum Industry	PT	PT
21	191PT5O02	Fundamentals of Petroleum Industry	PT	PT
22	191AG5O01	Basic Crop Production Practices	Ag.E	Ag.E

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OPEN ELECTIVE - II (VI Semester)

S. No	Course Code	Course Name	Not Offered to Branches	Offered By Department
1	191CE6O02	Disaster Management		CE
2	191EE6O04	Energy Audit and Conservation Management	EEE	EEE
3	191EE6O05	Non Conventional Energy resources	EEE	EEE
4	191EE6O06	Instrumentation	EEE, ECE, Ag. E	EEE
5	191ME6O06	Solar Energy Utilisation	ME, Ag. E	ME
6	191ME6O07	Basic Thermodynamics and Heat Transfer	EEE, ME, PT, Ag.E, Min.E	ME
7	191ME6O08	Introduction to Hydraulics and Pneumatics	CE, ME, PT	ME
8	191ME6O09	3D Printing	ME	ME
9	191ME6O10	Robotics	ME	ME
10	191ME6O11	Management Science	CE, CSE, IT, PT, Min. E	ME
11	191ME6O12	Entrepreneurship Development and Incubation		ME
12	191EC6O04	Biomedical Instrumentation		ECE
13	191EC6O05	ECAD Tools	ECE	ECE
14	191CS6O05	Python Programming	EEE, CSE, IT	CSE
15	191CS6O06	Operating Systems	CSE, IT	CSE
16	191CS6O07	Web Technologies	CSE, IT	CSE
17	191CS6O08	Cyber Security	CSE, IT	CSE
18	191CS6O09	AR / VR		CSE
19	191IT6O03	Computer Organization	CSE, IT	IT
20	191IT6O04	AI Tools & Techniques	CSE, IT	IT
21	191IT6O05	Robotic Process Automation		IT
22	191MI6O02	Industrial Safety Practices	Ag.E	Min.E
23	191MI6O03	Electrical Equipment's in Mines		Min.E
24	191PT6O03	Unconventional Hydrocarbon Resources	PT	PT
25	191PT6O04	Asset Management		PT
26	191AG6O02	Weather forecast in Agriculture		Ag.E
27	191AG6O03	Bio-energy systems design and applications		Ag.E

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VII SEMESTER

Course Code	Course Title	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
171EC7T16	Microwave Engineering	PC	3	1	0	4	3
171EC7T17	Digital Image Processing	PC	3	1	0	4	3
171EC7T18	Electronic Measurements And Instrumentation	PC	3	1	0	4	3
171EC7T19	Optical Communications	PC	3	1	0	4	3
---	**Professional Elective – IV**	PE	3	1	0	4	3
---	**Professional Elective – V**	PE	3	1	0	4	3
171EC7L10	Microwave Engineering and Optical Communications Lab	PC	0	0	3	3	2
171EC7L11	Digital Signal and Image Processing Lab	PC	0	0	3	3	2
171EC7P01	Industry Oriented (Internship) Minor Project	PR	0	0	0	0	2
		Total	**18**	**6**	**6**	**30**	**24**

VIII SEMESTER

Course Code	Course Title	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
---	**Professional Elective – VI**	PE	3	1	0	4	3
---	**Open Elective**	OE	3	1	0	4	3
171EC8P02	**Major Project**	PR	0	0	0	0	14
		Total	**6**	**2**	**0**	**8**	**20**

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Professional Elective – I (V Semester)

S.No	Course Code	Name of the Course
1	171EC5E01	Computer Architecture and Organization
2	171EC5E02	OOPS through JAVA
3	171EC5E03	Electronic Switching Systems

Professional Elective – II (VI Semester)

S.No	Course Code	Name of the Course
1	171EC6E04	CPLD and FPGA Architectures
2	171EC6E05	Operating Systems
3	171EC6E06	Computer Networks

Professional Elective – III (VI Semester)

S.No	Course Code	Name of the Course
1	171EC6E07	Digital Design Through Verilog
2	171EC6E08	Biomedical Engineering
3	171EC6E09	Information Theory and Coding

Professional Elective – IV (VII Semester)

S.No	Course Code	Name of the Course
1	171EC7E10	Digital Signal Processors
2	171EC7E11	Embedded Systems
3	171EC7E12	Cellular and Mobile Communications

Professional Elective – V (VII Semester)

S.No	Course Code	Name of the Course
1	171EC7E13	Analog IC Design
2	171EC7E14	Cryptography and Network Security
3	171EC7E15	Radar Systems

Professional Elective – VI (VIII Semester)

S.No	Course Code	Name of the Course
1	171EC8E16	Mixed Signal IC Design
2	171EC8E17	Wireless Sensors and Networks
3	171EC8E18	Satellite Communications

Open Elective (VIII Semester)

S.No	CourseCode	Name of the Course
1	171EC8O01	Basic Concrete Technology
2	171CE8O04	Waste Water Management
3	171EE8O05	Robotics
4	171EC8O02	Disaster Management
5	171EE8O07	Internet of Things
6	171EC8O03	Neural Networks
7	171CE8O03	Alternative Energy Sources
8	171CE8O02	Database Management Systems
9	171EC8O04	Web Technologies
10	171CE8O06	Green Fuel Technologies

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INTEGRATED CIRCUITS AND APPLICATIONS LAB

V Semester — L T P C

Course Code:191EC5L05 — 0 0 3 1.5

Course Outcomes :

At the end of the Course, Student will be able to:

- CO1 : Experiment with Op-Amp circuits for linear and non linear applications with the given specifications.
- CO2 : Design Butterworth filters using Op-Amps with given specification.
- CO3 : Design Waveform Generator using IC555 with variable duty cycle.
- CO4 : Evaluate Capture and Lock range using PLL.
- CO5 : Design Dual Power Supply using 78XX and 79XX.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	2	-	-	-
CO2	2	2	1	-	-	-	-	-	2	-	-	-
CO3	2	2	2	-	-	-	-	-	2	-	-	-
CO4	2	2	1	-	-	-	-	-	2	-	-	-
CO5	2	2	1	-	-	-	-	-	2	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO 1	PSO 2
CO1	3	-
CO2	2	-
CO3	2	-
CO4	3	-
CO5	2	-

List of Experiments:

1. Construct basic Applications of Op-Amp – Adder, Subtractor, Comparator Circuits.
2. Design of an Integrator and Differentiator Circuits using Op-Amp 741.
3. Construct Waveform Generator using single Op-Amp with variable duty cycle
4. Design Schmitt Trigger Circuits using Single OP-AMP with Reference voltage.
5. Design a Function Generator using Op-Amp for bandwidth up to 1MHz.
6. Design an Active Filters1 – LPF, HPF (first order) using Op-Amp 741.
7. Design an Active Filters2 – BPF, Band Reject (Wideband) and Notch Filters using Op- Amp 741.
8. Construct Monostable and Astable multivibrator using IC 555 Timer.
9. Evaluate Capture range and Lock range using PLL IC565..
10. Design of Dual Power Supply using 78XX and 79XX and full wave Bridge Rectifier with shunt capacitance filters).

Augmented on Experiments:

(Any two of the following experiments can be performed)

11. Design a 4-bit R-2R Ladder network with Op-Amp Buffer and Measure the output waveform for various input combinations.

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12. Cónstruct Waveform Generator using 8038 for a fixed frequency and trace the output waveform.
13. Design and Construct ± 12V DC Power Supply using Three terminal Voltage Regulators 7812and7912.
14. Design of oscillator Circuits – Phase Shift and Wien Bridge Oscillators using single Op-Amp

Equipment required for Laboratories:

1. Dual TRPS
2. CRO
3. Function Generators1MHz
4. Multi Meters (Digital, FET input Voltmeters)
5. Analog IC Trainer Kits
6. Bread Boards
7. Components: - IC741, IC555, IC565, IC566, IC723, 7805, 7809, 7912,8038 and other

Essential components:

1. Analog IC Tester.

REFERENCES:

1. Linear Integrated Circuits – D. Roy Chowdhury, New Age International (p) Ltd, 2nd Edition,2003.
2. Ramakant A. Gayakwad - Op-Amps and Linear Integrated Circuits, 4th Edition, PHI, Pearson Education, 2003.

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VLSI DESIGN

VI Semester | | **L T P C**
Course Code: 191EC6T13 | | **3 0 0 3**

Course Outcomes:

At the end of the Course, Student will be able to:

- CO 1: Outline the fundamental concepts related to MOS and Bi-CMOS Circuits fabrication.
- CO 2: Analyze the electrical properties of MOS and BiCMOS Circuits.
- CO 3: Make use of design rules for stick and layout diagrams.
- CO 4: Construct alternative forms of loads towards effective performance by subsystems.
- CO 5: Interpret FPGA and ASIC design approaches for semi custom design.

Mapping of course outcomes with program outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	3	1	1	-	-	-	-	-	-	-	-	1
CO2	2	1	2	-	-	-	-	-	-	-	-	1
CO3	2	2	3	-	-	-	-	-	-	-	-	2
CO4	1	1	3	-	-	-	-	-	-	-	-	1
CO5	1	1	2	-	-	-	-	-	-	-	-	3

Mapping of course outcomes with program Specific Outcomes:

CO/PSO	PSO 1	PSO 2
CO1	3	-
CO2	2	-
CO3	2	-
CO4	1	-
CO5	2	-

UNIT-I

Introduction: Introduction to IC Technology, MOS and related VLSI Technology, Basic MOS Transistors, Enhancement and Depletion modes of transistor action, IC production process, MOS and CMOS Fabrication processes, Bi-CMOS Technology, Comparison between CMOS and Bipolar technologies.

UNIT-II

Basic Electrical Properties of MOS and Bi-CMOS Circuits: Ids versus V_{ds} Relationships, Aspects of MOS transistor: Threshold Voltage, MOS transistor Trans-conductance, Output Conductance and Figure of Merit. The Pass transistor, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter. Alternative forms of pull-up, The CMOS Inverter, MOS transistor circuit model, Bi- CMOS Inverter, Latch-up in CMOS circuits and Bi-CMOS Latch-up Susceptibility. Transistor switches, Schematics of Inverter, NAND, NOR gates using NMOS, PMOS and CMOS technologies

UNIT-III

MOS and Bi-CMOS Circuit Design Processes: MOS Layers, Design Rules, General observations of design rules, 2μm Double Metal, Double Poly, CMOS/Bi-CMOS rules, 1.2μmDouble Metal, Double Poly CMOS rules, Stick Diagrams, Layout Diagrams of

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NAND and NOR gates and CMOS inverter, Symbolic Diagrams-Translation to Mask Form.

UNIT-IV

Basic Circuit Concepts & Scaling of MOS Circuits: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, The Delay Unit, Inverter Delays, Propagation Delays, Wiring Capacitances, Fan-in and fan-out characteristics, Choice of layers. Scaling models, Scaling factors for device parameters,

Subsystem Design: Architectural issues, switch logic, Gate logic, examples of structured design, clocked sequential circuits, system considerations, an illustration of design processes.

UNIT-V

VLSI Design Issues: VLSI Design issues and design trends, technology options, power calculations, package selection, clock mechanisms, mixed signal design, ASIC design flow, and introduction to SoC design. Over view on DFT (qualitative treatment only)

FPGA Design: Basic FPGA architecture, FPGA configuration, configuration modes, FPGA design process- FPGA design flow, FPGA families.

Text Books:

1. Essentials of VLSI Circuits and Systems By Kamran Eshraghian, Douglas and A. Pucknell, SholehEshraghian, Prentice-Hall of India Private Limited, 2005.
2. Modern VLSI Design-Wolf Wayne, Pearson Edition, 3rd Edition, 1997.
3. VLSI Design, Black Book by Dr. K.V.K.K. Prasad, KattulaShyamala, Kogent Learning Solutions Inc, 2012.

Reference Books:

1. CMOS Digital Integrated Circuits Analysis & Design, Sung-Mo (Steve) Kang, Yusuf Leblebici, Tata McGraw-Hill, 3rd Edition, 2002.
2. VLSI Design, K. LalKishore, V.S.V.Prabhakar, I.K. International Publishing House Private Limited, 1st Edition, 2009.

Web Links:

1. https://nptel.ac.in/courses/106/105/106105161/ Prof. Indranil Sengupta, IIT kharagpur
2. https://nptel.ac.in/courses/117/101/117101004/ Prof. A. N. Chandorkar, IIT Bombay
3. https://nptel.ac.in/courses/108/101/108101089/ Prof. A. N. Chandorkar, IIT Bombay

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INFORMATION THEORY AND CODING

(Professional Elective –II)

VI Semester **L T P C**
Course Code: 191EC6E07 **3 0 0 3**

Course Outcomes:

At the end of the Course, Student will be able to:

CO 1: Explain the basic concepts of information, Entropy, and Source coding.
CO 2: Calculate the mutual information and channel capacity.
CO 3: Develop the linear block codes for the given data.
CO 4: Develop the cyclic codes and BCH codes for the given data.
CO 5: Explain the convolution and space-time coding and decoding techniques and cryptography.

Mapping of course outcomes with program outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	2	3	-	-	-	-	-	-	-	-	-	1
CO3	2	2	1	-	-	-	-	-	-	-	-	1
CO4	2	2	1	-	-	-	-	-	-	-	-	1
CO5	2	2	1	-	-	-	-	-	-	-	-	1

Mapping of course outcomes with program Specific Outcomes:

CO/PSO	PSO 1	PSO 2
CO1	2	-
CO2	2	-
CO3	3	-
CO4	3	-
CO5	2	-

UNIT-I

Information theory, source coding and channel capacity: Entropy, Mutual information, Conditional, and Joint Entropy. Measures for Continuous, Random variable, Relative Entropy. Variable-length codes, Prefix codes, Source coding theorem, various source coding techniques: Huffman, Arithmetic, Lempel Ziv, Run Length. Channel models and channel capacity, Noisy channel and coding theorem and its application to BSC, Shannon's theorem on channel capacity, capacity of a channel of infinite bandwidth, bandwidth-S/N trade off, Fading channel, channels with memory, capacity of MIMO channels.

UNIT-II

Error Control Codes: Introduction to Error Control Coding, Galois field, Generator matrix, Parity check matrix, systematic codes, error detection and corrections, standard array and syndrome decoding, Probability of error, coding gain, Hamming bound, Hamming codes, LDPC codes, and MDS codes.

UNIT-III

Cyclic codes and BCH codes: Introduction to Cyclic codes, Generator, and parity check matrix of cyclic codes, syndrome computation, and error detection. Fire code,

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Golay code and CRC codes, Circuit implementation of cyclic codes, multiple error-correcting BCH codes, decoding of BCH codes, Reed-Solomon codes, error location, and correction.

UNIT-IV

Convolutional codes and Space-Time codes: Introduction to convolution code, Trellis codes: Generator polynomial matrix and Encoding using Trellis, Viterbi algorithm for maximum likelihood decoding, Automatic repeat request (ARQ) strategies, Probability of error, throughput efficiency considerations, Turbo Codes, Introduction to Trellis Coded Modulation (TCM), TCM for fading channel, Space-Time Trellis Codes (STTC), Space-Time Block Codes (STBC).

UNIT-V

Cryptography and Physical layer security: Introduction to Cryptography: Symmetric key and Asymmetric Key Cryptography, Some well-known algorithms: DES, IDEA, PGP, DH Protocol, Introduction to Physical Layer Security: Notion of Secrecy Capacity, Secrecy Outage Capacity, Secrecy Outage Probability, Cooperative Jamming.

Text Books:

1. Error Control Coding-Fundamentals and Applications, Shu Lin, Daniel J. Costello, Jr., Prentice Hall, Inc 2014.
2. Modern Analog and Digital Communication Systems, Lathi B. P., Oxford Univ. Press, Third Edition, 2004.

Reference Books:

1. Digital Communications, J. G. Proakis, McGraw Hill Education; Fifth edition. 2018.
2. Introduction to error control codes, Salvatore Gravano, Oxford University Press, 2007.
3. Information Theory, Coding, and Cryptography, Ranjan Bose, McGraw Hill Education; Second Edition, 2008

Web Links:

1. https://nptel.ac.in/courses/108/108/108108168/InformationTheory, Prof. Himanshu Tyagi, Electrical Engineering, IISc Bangalore.
2. https://nptel.ac.in/courses/108/102/108102117/Information Theory, Coding, and Cryptography, Prof. Ranjan Bose, Electrical Engineering, IIT Delhi.
3. http://d1.amobbs.com/bbs_upload782111/files_35/ourdev_604508GHLFR2.pdf

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COMPUTER SYSTEM ARCHITECTURE
(Professional Elective-I)

V Semester **L T P C**
Course Code:191EC5E01 **3 0 0 3**

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1: Develop a detailed understanding of computer systems
CO 2: Explain about different number systems, binary addition and subtraction, standard, floating-point, and micro operations
CO 3: Develop a detailed understanding of architecture and functionality of central processing unit
CO 4: Illustrate in a better way the I/O and memory organization
CO 5: Illustrate the concepts of parallel processing, pipelining and inter process communication

Mapping of course outcomes with program outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-

Mapping of course outcomes with program Specific Outcomes:

CO/PSO	PSO 1	PSO 2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

UNITI
Basic Structure of Computers: Basic Organization of Computers, Historical Perspective, Bus Structures,
Data Representation: Data types, Complements, Fixed Point Representation. Floating – Point Representation. Other Binary Codes, Error Detection Codes. **Computer Arithmetic:** Addition and Subtraction, Multiplication Algorithms, Division Algorithms.

UNIT II
Register Transfer Language and Microoperations: Register Transfer language. Register Transfer Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit.

Basic Computer Organization and Design: Instruction Codes, Computer Register, Computer Instructions, Instruction Cycle, Memory – Reference Instructions. Input – Output and Interrupt, Complete Computer Description.

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UNITIII

Central Processing Unit: General Register Organization, STACK Organization. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

Microprogrammed Control: Control Memory, Address Sequencing, Micro Program example, Design of Control Unit.

UNIT IV

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, Direct Memory Access.

UNIT V

Multi Processors: Introduction, Characteristics of Multiprocessors, Interconnection Structures, Inter Processor Arbitration.

Pipeline: Parallel Processing, Pipelining, Instruction Pipeline, RISC Pipeline, Array Processor.

Text Books:

1. Computer System Architecture, M. Morris Mano, Third Edition, Pearson, 2008.
2. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 5/e, McGraw Hill, 2002.

Reference Books:

1. Computer Organization and Architecture, William Stallings, 6/e, Pearson, 2006.
2. Structured Computer Organization, Andrew S. Tanenbaum, 4/e, Pearson, 2005.
3. Fundamentals of Computer Organization and Design, Sivarama P. Dandamudi, Springer, 2006

Web Links:

1. https://nptel.ac.in/courses/106/105/106105163/
2. http://www.cuc.ucc.ie/CS1101/David%20Tarnoff.pdf

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VLSI LAB

VI Semester

Course Code: 191EC6L08

L	T	P	C
0	0	3	1.5

Course Outcomes:

At the end of the Course, Student will be able to:

CO 1: Contrast different levels of abstraction in HDL-Verilog.
CO 2: Develop the Verilog code for digital logic circuits.
CO 3: Analyze the cost parameters – area, delay and power dissipation of Digital Circuits on FPGA Hardware
CO 4: Develop logic schematics as per the list of specifications from user.
CO 5: Interpret the concepts of DRC, LVS and PEX in designing the ICs.

Mapping of course outcomes with program outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	2	2	-	-	2	-	-	-	2	-	-	-
CO2	2	2	-	-	2	-	-	-	2	-	-	-
CO3	2	2	-	-	2	-	-	-	2	-	-	-
CO4	2	2	-	-	2	-	-	-	2	-	-	-
CO5	1	2	-	-	3	-	-	-	2	-	-	-

Mapping of course outcomes with program Specific Outcomes:

CO/PSO	PSO 1	PSO 2
CO1	2	-
CO2	3	-
CO3	3	-
CO4	3	-
CO5	3	-

List of Experiments:

PART (A): Front-end design and Implementation

Note 1: The students need to develop Verilog Source code, perform simulation using relevant simulator and analyze the obtained simulation results using necessary Synthesizer.

Note 2: All the experiments need to be implemented on the latest FPGA/CPLD Hardware in the Laboratory

1. Realization of Logic gates
2. Design and Implementation Flip-Flops
3. Design and Implementation of full Adder in different styles.
4. Design and Implementation 3:8 decoder realization through 2:4 decoder
5. Design and Implementation 8-bit synchronous up-down counter

PART (B): Back-end Level Design and Implementation

Note: The students need to design the following experiments at schematic level using CMOS logic and verify the functionality. Further students need to draw the corresponding layout and verify the functionality including parasites. Available state of the art technology libraries can be used while simulating the designs using Industry standard EDA Tools.

1. An Inverter
2. Universal Gates
3. Full Adder

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List of Augmented Experiments:
(Any two of the following experiments can be performed)

1. Design and Implementation of 16:1 mux through 4:1 mux
2. Design and Implementation of sequence detector
3. Layout design for SR latch

EDA Tools/Hardware Required:

PART (A):

1. Xilinx Vivado software / Equivalent Industry Standard Software
2. Xilinx Hardware / Equivalent hardware
3. Personal computer system with necessary software to run the programs and Implement.

PART (B):

4. Mentor Graphics Software / Cadence/Synopsys/Tanner or Equivalent Industry Standard/CAD Tool.
5. Desktop computer with appropriate Operating System that supports the EDA tools.

Reference Books:

1. CMOS Digital Integrated Circuits, Sung Mo Kang, MHeducation, 3rd Edition
2. Fundamentals of Digital Logic with Verilog Design- Stephen Brown, ZvonkoVranesic, McGrawHill, 3rd Edition, 2013.
3. A Verilog HDL Primer by J.Bhaskar, Star galaxy publishing, 3rd edition,2018.

Web Links:

1. https://onlinecourses-archive.nptel.ac.in/noc17_cs21/course by Prof. Indranil Sen Gupta, IIT Kharagpur
2. http://nptel.ac.in/courses/117106086/1 by Prof.S.Srinivasan, IIT Madras
3. http://nptel.ac.in/courses/117108040/ by Kuruvilla Varghese, IISc Bangalore

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Department of Electronics and communication Engineering

Syllabus revision Index

2021-22

S.No	Name of the course	Percentage of syllabus change
1	Computer System Architecture	20
2	Integrated circuits and applications lab	25
3	VLSI Design	20
4	Information Theory and Coding	30
5	VLSI Lab	50

Signature of the HOD

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Department of Electronics and communication Engineering

1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	**Computer architecture and organization**	**Computer System Architecture**
Course Code	171EC5E01	191EC5E01
Syllabus	**UNIT I:** **Basic Structure of Computers:** Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance. **Computer Arithmetic:** Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating point Arithmetic operations, Decimal Arithmetic unit, Decimal Arithmetic operations.	UNIT-I **Basic Structure of Computers**: Basic Organization of Computers, Historical Perspective, Bus Structures, **Data Representation:** Data types, Complements, Fixed Point Representation. Floating – Point Representation. Other Binary Codes, Error Detection Codes. **Computer Arithmetic:** Addition and Subtraction, Multiplication Algorithms, Division Algorithms.
	UNIT II: **Register Transfer Language and Micro-Operations:** Register Transfer language. Register Transfer, Bus and memory Transfer, Types of Micro-operations, Arithmetic logic shift unit, Instruction codes, Computer Registers, Computer instructions, Instruction cycle, Memory Reference Instructions, Input Output and Interrupt.	UNIT-II Register Transfer Language and Microoperations: Register Transfer language. Register Transfer Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit. Basic Computer Organization and Design: Instruction Codes, Computer Register, Computer Instructions, Instruction Cycle, Memory – Reference Instructions. Input –Output and Interrupt, Complete Computer Description.
	UNIT III: **Central Processing Unit:** Stack organization, Instruction formats, Addressing modes, Data Transfer and manipulation, Program control, Reduced Instruction Set	**UNIT-III** **Central Processing Unit:** General Register Organization, STACK Organization. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control,

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	Computer (RISC). **Micro Programmed Control:** Control memory, Address sequencing, Micro program example, Design of control unit-Hard wired control, Micro programmed control	Reduced Instruction Set Computer. **Microprogrammed Control:** Control Memory, Address Sequencing, Micro Program example, Design of Control Unit.
	UNIT IV: **The Memory System:** Memory Hierarchy, Main memory, Auxiliary memory, Associative memory, Cache memory, Virtual memory. **Input-Output Organization:** Peripheral Devices, Input-Output Interface, Asynchronous data Transfer Modes, Priority Interrupt, Direct Memory Access (DMA), Input – Output Processor (IOP)	**UNIT-IV** **Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory. **Input-Output Organization:** Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, Direct Memory Access.
	UNIT V: **Pipeline and Vector Processing:** Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors. **Multi Processors:** Characteristics of Multiprocessors, Interconnection Structures, Inter-processor Arbitration, Inter-processor Communication and Synchronization, Cache Coherence.	**UNIT-V** **Multi Processors:** Introduction, Characteristics of Multiprocessors, Interconnection Structures, Inter Processor Arbitration. **Pipeline:** Parallel Processing, Pipelining, Instruction Pipeline, RISC Pipeline, Array Processor.

Signature of the course coordinator

G. Saidas

Signature of the HOD

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Department of Electronics and communication Engineering

1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	**Integrated circuits and applications lab**	**Linear ic applications lab**
Course Code	171EC5L04	191EC5L05
Syllabus	**List of Experiments:** 1. Explain about the Functioning, Parameters and Specifications of ICs-IC 741, IC 555, IC 565, IC 566, IC 1496. 2. Perform addition and Subtraction using inverting mode Op-Amp and design the Comparator circuit. 3. Construct and test the performance of an Integrator and Differentiator using IC 741. 4. Design and verify the operation of the Active low pass and high pass filters using IC 741 and plot its frequency response. 5. Verify the working of RC phase shift and Wien's bridge oscillator using IC 741 and draw output waveforms. 6. Design a Function Generator circuit to generate square wave and triangular wave using Op-Amp? 7. Design and verify the operation of Monostable Multivibrator using IC 555. 8. Verify the working of Astable Multivibrator using IC 555 timer. Find the duty cycle of output waveform?	List of Experiments: 1. Construct basic Applications of Op-Amp – Adder, Subtractor, Comparator Circuits. 2. Design of an Integrator and Differentiator Circuits using Op-Amp 741. 3. Construct Waveform Generator using single Op-Amp with variable duty cycle 4. Design Schmitt Trigger Circuits using Single OP-AMP with Reference voltage. 5. Design a Function Generator using Op-Amp for bandwidth up to 1MHz. 6. Design an Active Filters1 – LPF, HPF (first order) using Op-Amp 741. 7. Design an Active Filters2 – BPF, Band Reject (Wideband) and Notch Filters using Op- Amp 741. 8. Construct Monostable and Astable multivibrator using IC 555 Timer. 9. Evaluate Capture range and Lock range using PLL IC565.. 10. Design of Dual Power Supply using 78XX and 79XX and full wave Bridge Rectifier with shunt capacitance filters). Augmented on Experiments: (Any two of the following experiments can be performed) 11.Design a 4-bit R-2R Ladder network

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	9. Verify the operation of Schmitt trigger using Op-Amp IC 741 and IC 555. Draw the output waveforms and calculate hysteresis width? 10. Design a 4-bit R-2R Digital to Analog Converter using Op-Amp IC and Plot I/O curve. **List of Augmented Experiments: (Minimum of two experiments has to be performed)** 1. Construct Integrator and Differentiator using IC 741 and verify its operation using P-SPICE. 2. Simulate and verify the RC phase shift and Wien's bridge oscillators using P-SPICE and draw output waveforms. 3. Simulate and verify the Active low pass and high pass filters using P-SPICE. 4. Verify the characteristics of PLL using IC 565. 5. Compare the response of Voltage regulator using IC 723 and Three Terminal Voltage Regulators – 7805, 7809, 7912.	with Op-Amp Buffer and Measure the output waveform for various input combinations. 12. Construct Waveform Generator using 8038 for a fixed frequency and trace the output waveform. 13. Design and Construct ± 12V DC Power Supply using Three terminal Voltage Regulators 7812and7912. 14. Design of oscillator Circuits – Phase Shift and Wien Bridge Oscillators using single Op-Amp

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Department of Electronics and communication Engineering

1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	VLSI Design	VLSI Design
Course Code	171EC6T14	191EC6T13
	UNIT I: **Introduction:** Introduction to IC Technology, MOS and related VLSI Technology, Basic MOS Transistors, Enhancement and Depletion modes of transistor action, IC production process, MOS and CMOS Fabrication processes, BiCMOS Technology, Comparison between CMOS and Bipolar technologies.	**UNIT I:** **Introduction:** Introduction to IC Technology, MOS and related VLSI Technology, Basic MOS Transistors, Enhancement and Depletion modes of transistor action, IC production process, MOS and CMOS Fabrication processes, Bi-CMOS Technology, Comparison between CMOS and Bipolar technologies.
Syllabus	**UNIT II:** **Basic Electrical Properties of MOS and Bi-CMOS Circuits:** Ids versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistorTrans, Output Conductance and Figure of Merit. The Pass transistor, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by anotherNMOS inverter. Alternative forms of pull-up, The CMOS Inverter, MOS transistor circuit model, Bi-CMOS Inverter, Latch-up in CMOS circuits and BiCMOS Latch-up Susceptibility.	**UNIT II:** **Basic Electrical Properties of MOS and Bi-CMOS Circuits:** Ids versus Vds Relationships, Aspects of MOS transistor: Threshold Voltage, MOS transistor Trans-conductance, Output Conductance and Figure of Merit. The Pass transistor, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter. Alternative forms of pull-up, The CMOS Inverter, MOS transistor circuit model, Bi- CMOS Inverter, Latch-up in CMOS circuits and Bi-CMOS Latch-up Susceptibility. Transistor switches, Schematics of Inverter, NAND, NOR gates using NMOS, PMOS and CMOS technologies
	UNIT III: **MOS and Bi-CMOS Circuit Design Processes:**	**UNIT-III:** **MOS and Bi-CMOS Circuit Design Processes:** MOS Layers, Design Rules,

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	MOS Layers, Stick Diagrams, Design Rules and Layout, General observations of design rules, 2µm Double Metal, Double Poly, CMOS/BiCMOS rules, 1.2µmDouble Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter, Symbolic Diagrams-Translation to Mask Form. **Basic Circuit Concepts:** Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, The Delay Unit, Inverter Delays, Propagation Delays, Wiring Capacitances, Fan-in and fan-out characteristics, Choice of layers, Transistor switches, Realization of gates using NMOS, PMOS and CMOS technologies.	General observations of design rules, 2µm Double Metal, Double Poly, CMOS/Bi-CMOS rules, 1.2µmDouble Metal, Double Poly CMOS rules, Stick Diagrams, Layout Diagrams of NAND and NOR gates and CMOS inverter, Symbolic Diagrams-Translation to Mask Form.
	UNIT IV: **Scaling of MOS Circuits:** Scaling models, Scaling factors for device parameters, Limits due to sub threshold currents, current density limits on logic levels and supply voltage due to noise. **Subsystem Design:** Architectural issues, switch logic, Gate logic, examples of structured design, clocked sequential circuits, system considerations, general considerations of subsystem design processes,	**UNIT-IV:** **Basic Circuit Concepts & Scaling of MOS Circuits:** Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, The Delay Unit, Inverter Delays, Propagation Delays, Wiring Capacitances, Fan-in and fan-out characteristics, Choice of layers. Scaling models, Scaling factors for device parameters, **Subsystem Design:** Architectural issues, switch logic, Gate logic, examples of structured design, clocked sequential circuits, system considerations, an illustration of design processes.
	UNIT V: **VLSI Design Issues:** VLSI Design issues and design trends, design process, design for testability, technology options, power calculations, package selection, clock	**UNIT-V:** VLSI Design Issues: VLSI Design issues and design trends, technology options, power calculations, package selection, clock mechanisms, mixed signal design, ASIC design flow, and

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	mechanisms, mixed signal design, ASIC design flow, and introduction to SoC design. **FPGA Design:** Basic FPGA architecture, FPGA configuration, configuration modes, FPGA designs process- FPGA design flow, FPGA families.	introduction to SoC design. Over view on DFT (qualitative treatment only) **FPGA Design:** Basic FPGA architecture, FPGA configuration, configuration modes, FPGA design process- FPGA design flow, FPGA families.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Information Theory and Coding	Information Theory and Coding
Course Code	171EC6E09	191EC6E07
Syllabus	**UNIT I:** **Information theory and source coding:** Uncertainty, information, entropy and its properties, entropy of binary memory less source and its extension to discrete memory less source, source coding theorem, data compression, prefix coding, Huffman coding, Lempel-Ziv coding, Source with memory and its entropy.	**UNIT-I:** **Information theory, source coding and channel capacity:** Entropy, Mutual information, Conditional, and Joint Entropy. Measures for Continuous, Random variable, Relative Entropy. Variable-length codes, Prefix codes, Source coding theorem, various source coding techniques: Huffman, Arithmetic, Lempel Ziv, Run Length. Channel models and channel capacity, Noisy channel and coding theorem and its application to BSC, Shannon's theorem on channel capacity, capacity of a channel of infinite bandwidth, bandwidth-S/N trade off, Fading channel, channels with memory, capacity of MIMO channels.
	UNIT II: **Discrete channels:** Binary Symmetric Channel, mutual information & its properties, Channel capacity, channel coding theorem and its application to BSC, Shannon's theorem on channel capacity, capacity of a channel of infinite bandwidth, bandwidth - S/N trade off, practical communication systems in light of Shannon's theorem, Fading channel, channels with memory.	**UNIT-II:** **Error Control Codes:** Introduction to Error Control Coding, Galois field, Generator matrix, Parity check matrix, systematic codes, error detection and corrections, standard array and syndrome decoding, Probability of error, coding gain, Hamming bound, Hamming codes, LDPC codes, and MDS codes.
	UNIT III: **Groups, fields and linear block codes:** Galois field and its construction in	UNIT-III: Cyclic codes and BCH codes: Introduction to Cyclic codes, Generator,

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	GF(2m) and its basic properties, vector spaces and matrices in GF(2), Linear block codes, systematic codes and its encoding circuit, syndrome and error detection, minimum distance, error detecting and correcting capabilities of block code, decoding circuit, probability of undetected error for linear block code in BSC, Hamming code and their applications.	and parity check matrix of cyclic codes, syndrome computation, and error detection. Fire code, Golay code and CRC codes, Circuit implementation of cyclic codes, multiple error-correcting BCH codes, decoding of BCH codes, Reed-Solomon codes, error location, and correction.
	UNIT IV: **Cyclic codes and BCH codes:** Basic properties of Cyclic codes, Generator and parity check matrix of cyclic codes, Encoding and Decoding circuits, syndrome computation and error detection, cyclic Hamming codes, encoding and decoding of BCH codes, error location and correction.	**UNIT-IV:** **Convolutional codes and Space-Time codes**: Introduction to convolution code, Trellis codes: Generator polynomial matrix and Encoding using Trellis, Viterbi algorithm for maximum likelihood decoding, Automatic repeat request (ARQ) strategies, Probability of error, throughput efficiency considerations, Turbo Codes, Introduction to Trellis Coded Modulation (TCM), TCM for fading channel, Space-Time Trellis Codes (STTC), Space-Time Block Codes (STBC).
	UNIT V: **Convolutional codes:** Introduction to convolution code, its construction and Viterbi algorithm for maximum likelihood decoding, Automatic repeat request strategies and their throughput efficiency considerations, Turbo Codes	**UNIT-V:** **Cryptography and Physical layer security**: Introduction to Cryptography: Symmetric key and Asymmetric Key Cryptography, Some well-known algorithms: DES, IDEA, PGP, DH Protocol, Introduction to Physical Layer Security: Notion of Secrecy Capacity, Secrecy Outage Capacity, Secrecy Outage Probability, Cooperative Jamming.

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G. Seshadri

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Department of Electronics and communication Engineering

1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	VLSI Lab	VLSI Lab
Course Code	171EC6L08	191EC6L08
Syllabus	1. Digital circuit simulation 2. Digital circuits Schematics and its functional response verification of logic gates 3. Digital circuits Schematics and its functional response verification of complex logic gates and combinational circuits 4. Layout Extraction of Logic gates. 5. Layout Extraction of complex gates and combinational circuits 6. Performing DRC for logic gates 7. Performing DRC for complex gates and combinational circuits 8. Performing LVS / Net list extraction for logic gates 9. Performing LVS / Net list extraction for complex gates and combinational circuits 10. PEX estimation for the given logic circuits 11. PEX estimation for the given complex gates and combinational circuits **Augmented Experiments: (Minimum of two experiments has to be performed)** 1. Layout design for specific constraints (delay, power dissipation) 2. DRC / LVS / PEX verification of Multiplexer. 3. DRC / LVS / PEX verification of a	PART (A): Front-end design and Implementation Note 1: The students need to develop Verilog Source code, perform simulation using relevant simulator and analyze the obtained simulation results using necessary Synthesizer. Note 2: All the experiments need to be implemented on the latest FPGA/CPLD Hardware in the Laboratory 1. Realization of Logic gates 2. Design and Implementation Flip-Flops 3. Design and Implementation of full Adder in different styles. 4. Design and Implementation 3:8 decoder realization through 2:4 decoder 5. Design and Implementation 8-bit synchronous up-down counter PART (B): Back-end Level Design and Implementation Note: The students need to design the following experiments at schematic level using CMOS logic and verify the functionality. Further students need to draw the corresponding layout and verify the functionality including parasites. Available state of the art technology libraries can be used while simulating the designs using Industry standard EDA Tools. 1. An Inverter

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	given SOP(Z= (AB+C)D)	2. Universal Gates 3. Full Adder List of Augmented Experiments: (Any two of the following experiments can be performed) 1. Design and Implementation of 16:1 mux through 4:1 mux 2. Design and Implementation of sequence detector 3. Layout design for SR latch

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Program Name : B.Tech. in Computer Science and Engineering

Syllabus Revision for the Academic Year 2021-2022

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
1	I	201HS1T01	Communicative English	0
2	I	201BS1T01	Differential Equations and Linear algebra	0
3	I	201BS1T04	Engineering Chemistry	0
4	I	201ES1T02	Programming for Problem Solving using C	0
5	I	201ES1I02	Computer Engineering Workshop	0
6	I	201HS1L01	Communicative English Lab	0
7	I	201BS1L03	Engineering Chemistry Lab	0
8	I	201ES1L02	Programming for Problem Solving using C Lab	0
9	I	201MC1T01	Environmental Science	0
10	II	201BS2T07	Numerical Methods and Complex Variables	0
11	II	201BS2T09	Applied Physics	0
12	II	201ES2T11	Computer Organization	0
13	II	201ES2T04	Python Programming	0
14	II	201ES2T07	Data Structures through C	0
15	II	201BS2L04	Applied Physics Lab	0
16	II	201ES2L06	Data Structures through C Lab	0
17	II	201ES2L14	Python Programming Lab	0
18	II	201MC2L01	Professional Communication Skills Lab	0
19	II	201MC2T02	Constitution of India	0
20	III	201CS3T01	Advanced Data Structures	50
21	III	201CS3T02	Object Oriented Programming through C++	100
22	III	201CS3T03	Operating Systems	55

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
23	III	201CS3T04	Software Engineering	25
24	III	201BS3T13	Discrete Mathematics	0
25	III	201CS3L01	Object Oriented Programming through C++ Lab	100
26	III	201CS3L02	Operating Systems Lab	0
27	III	201CS3L03	Unix and Shell Programming Lab	100
28	III	201SC3L05	Applications of python-numpy	100
29	III	201SC3L06	web application development using full stack frontend development–module –I	100
30	III	201MC3T03	Biology for Engineers	0
31	IV	201BS4T16	Probability and statistics	0
32	IV	201CS4T05	Formal Languages and Automata Theory	0
33	IV	201CS4T06	Database Management Systems	0
34	IV	201CS4T07	Java programming	0
35	IV	201HS4T03	Managerial Economics and Financial Accountancy	0
36	IV	201CS4L04	Database Management Systems Lab	0
37	IV	201CS4L05	Java Programming Lab	100
38	IV	201CS4L06	R Programming Lab	100
39	IV	201SC4L18	Applications of python- pandas	100
40	IV	201SC4L19	Web application development using full stack frontend development module-II	100
41	IV	201MC4T04	Essence of Indian Traditional Knowledge	0
42	V	191CS5T08	Compiler Design	0
43	V	191CS5T09	Computer Networks	0
44	V	191CS5T10	Database Management Systems	0
45	V	191CS5T11	Operating Systems	0
46	V	191CS5E04	Functional and Logic Programming	100
47	V	191CS5E01	Advanced Computer Architecture	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
48	V	191CS5E02	Artificial Intelligence	100
49	V	191CS5E05	Software Requirement and Estimation	100
50	V	191CS5E03	Computer Graphics	0
51	V	191CE5O01	Basic Concrete Technology	100
52	V	191EE5O01	Electrical Safety	100
53	V	191EE5O02	Electrical Materials	100
54	V	191EE5O03	Basic Electrical Measurements	100
55	V	191ME5O01	Renewable Energy Sources	100
56	V	191ME5O02	Fundamentals of Mechanical Engineering	100
57	V	191ME5O03	Supply Chain Management	100
58	V	191ME5O04	3D Printing	100
59	V	191ME5O05	Entrepreneurship Development and Incubation	100
60	V	191EC5O01	Signals & Systems	100
61	V	191EC5O02	Digital Electronics and Logic Design	100
62	V	191EC5O03	Semi conductor devices	100
63	V	191CS5O01	Data Structures	0
64	V	191CS5O02	Object Oriented Programming through C++	0
65	V	191CS5O03	Java Programming	0
66	V	191CS5O04	R Programming	0
67	V	191IT5O01	Data Base Management Systems	100
68	V	191IT5O02	Computer Graphics	100
69	V	191MI5O01	Overview of Mining	100
70	V	191PT5O01	Process Intensification in Petroleum Industry	100
71	V	191PT5O02	Fundamentals of Petroleum Industry	100
72	V	191AG5O01	Basic Crop Production Practices	100
73	V	191CS5L04	Operating Systems and Computer Networks Lab	100

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
74	V	191CS5L05	Database Management Systems Lab	0
75	V	191HS5T06	Employability Skills - III	0
76	V	191PR5P02	Socially Relevant Project	100
77	V	191MC5A08	Intellectual Property Rights and Patents	0
78	VI	191CS6T12	Data Ware Housing and Data Mining	0
79	VI	191CS6T13	Object Oriented Analysis and Design	100
80	VI	191CS6T14	Web Technologies	50
81	VI	191CS6E09	Scripting languages	100
82	VI	191CS6E06	Advance Operating Systems	100
83	VI	191CS6E08	Machine Learning	0
84	VI	191CS6E10	Software Testing Methodologies	60
85	VI	191CS6E07	Image Processing	50
86	VI	191CS6E11	C# .Net	100
87	VI	191CS6E13	Distributed Systems	100
88	VI	191CS6E14	Natural Language Processing	100
89	VI	191CS6E15	Software Quality Assurance	0
90	VI	191CS6E12	Cloud Computing	0
91	VI	191CE6O02	Disaster Management	100
92	VI	191EE6O04	Energy Audit and Conservation Management	100
93	VI	191EE6O05	Non Conventional Energy resources	100
94	VI	191EE6O06	Instrumentation	100
95	VI	191ME6O06	Solar Energy Utilisation	100
96	VI	191ME6O07	Basic Thermodynamics and Heat Transfer	100
97	VI	191ME6O08	Introduction to Hydraulics and Pneumatics	100
98	VI	191ME6O09	3D Printing	100
99	VI	191ME6O06	Robotics	100

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
100	VI	191ME6O09	Management Science	100
101	VI	191ME6O12	Entrepreneurship Development and Incubation	100
102	VI	191ME6O07	Biomedical Instrumentation	100
103	VI	191ME6O08	ECAD Tools	100
104	VI	191CS6O05	Python Programming	0
105	VI	191CS6O06	Operating Systems	0
106	VI	191CS6O07	Web Technologies	0
107	VI	191CS6O08	Cyber Security	0
108	VI	191CS6O09	AR / VR	0
109	VI	191IT6O03	Computer Organization	100
110	VI	191IT6O04	AI Tools & Techniques	100
111	VI	191IT6O05	Robotic Process Automation	100
112	VI	191MI6O02	Industrial Safety Practices	100
113	VI	191MI6O03	Electrical Equipment's in Mines	100
114	VI	191PT6O03	Unconventional Hydrocarbon Resources	100
115	VI	191PT6O04	Asset Management	100
116	VI	191AG6O02	Weather forecast in Agriculture	100
117	VI	191AG6O03	Bio-energy systems design and applications	100
118	VI	191CS6L06	Data Mining and Object Oriented Analysis and Design Lab	100
119	VI	191CS6L07	Web Technologies Lab	0
120	VI	191HS6T07	Employability Skills - IV	0
121	VI	191MC6A09	Professional Ethics and Human Values	0
122	VII	171CS7T18	Cryptography and Network Security	0
123	VII	171CS7T19	UML and Design Patterns	0
124	VII	171CS7T20	Cloud Computing	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
125	VII	171HS7T05	Management Science	0
126	VII	171CS7E13	Software Project Management	0
127	VII	171CS5E14	Big Data Analytics	0
128	VII	171CS7E15	Image Processing	0
129	VII	171CS7E16	Cyber Laws	0
130	VII	171CS7E17	Middleware Technologies	0
131	VII	171CS7E18	Artificial Intelligence and Machine Learning	0
132	VII	171CS7E19	Information Retrieval Systems	0
133	VII	171CS7E20	Mobile Computing	0
134	VII	171CS7L12	UML and Design Patterns Lab	0
135	VII	171CS7L13	Big Data Analytics Lab	0
136	VII	171CS7P01	Industry Oriented (Internship) Minor Project	0
137	VIII	171CS8E21	Agile Methodologies	0
138	VIII	171CS8E22	Cyber Security	0
139	VIII	171CS8E23	Distributed Databases	0
140	VIII	171CS8E24	Distributed Systems	0
141	VIII	171CS8O01	Microprocessor and Multi Core Systems	0
142	VIII	171CS8O02	Embedded Systems	0
143	VIII	171CS8O03	Soft Computing	0
144	VIII	171EE8O05	Robotics	0
145	VIII	171CS8O04	Operations Research	0
146	VIII	171CS8O05	Optical Communications	0
147	VIII	171EE8O07	Internet of Things	0
148	VIII	171EC8O02	Disaster Management	0
149	VIII	171CS8O06	Renewable Energy sources	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
150	VIII	171CS8O07	Nano Technology and its Applications	0
151	VIII	171CS8P02	Project Work	0
Total number of courses in the academic year 2021-2022				= 151
Number of courses having revision in syllabus content >/= 20% in the academic year 2021-2022				= 67
Percentage of syllabus revision carried out in the academic year 2021-2022 = (49/135)*100				= 44.37%

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1.1.2
21-22

PROGRAM STRUCTURE

I SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201HS1T01	Communicative English	HSMC	Theory	3	0	0	3	3
201BS1T01	Differential Equations and Linear algebra	BSC	Theory	3	0	0	3	3
201BS1T04	Engineering Chemistry	BSC	Theory	3	0	0	3	3
201ES1T02	Programming for Problem Solving using C	ESC	Theory	3	0	0	3	3
201ES1I02	Computer Engineering Workshop	ESC	Integrated	2	0	2	4	3
201HS1L01	Communicative English Lab	HSMC	Lab	0	0	3	3	1.5
201BS1L03	Engineering Chemistry Lab	BSC	Lab	0	0	3	3	1.5
201ES1L02	Programming for Problem Solving using C Lab	ESC	Lab	0	0	3	3	1.5
201MC1T01	Environmental Science	MC	Theory	2	0	0	2	0
			TOTAL	16	0	11	27	19.5

II SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS2T07	Numerical Methods and Complex Variables	BSC	Theory	3	0	0	3	3
201BS2T09	Applied Physics	BSC	Theory	3	0	0	3	3
201ES2T11	Computer Organization	ESC	Theory	3	0	0	3	3
201ES2T04	Python Programming	ESC	Theory	3	0	0	3	3
201ES2T07	Data Structures through C	ESC	Theory	3	0	0	3	3
201BS2L04	Applied Physics Lab	BSC	Lab	0	0	3	3	1.5
201ES2L06	Data Structures through C Lab	ESC	Lab	0	0	3	3	1.5
201ES2L14	Python Programming Lab	ESC	Lab	0	0	3	3	1.5
201MC2L01	Professional Communication Skills Lab	MC	Lab	0	0	3	3	0
201MC2T02	Constitution of India	MC	Theory	2	0	0	2	0
			TOTAL	15	0	16	31	19.5

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III SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201CS3T01	Advanced Data Structures	PCC	Theory	3	0	0	3	3
201CS3T02	Object Oriented Programming through C++	PCC	Theory	3	0	0	3	3
201CS3T03	Operating Systems	PCC	Theory	3	0	0	3	3
201CS3T04	Software Engineering	PCC	Theory	3	0	0	3	3
201BS3T13	Discrete Mathematics	BSC	Theory	3	0	0	3	3
201CS3L01	Object Oriented Programming through C++ Lab	PCC	Lab	0	0	3	3	1.5
201CS3L02	Operating Systems Lab	PCC	Lab	0	0	3	3	1.5
201CS3L03	Unix and Shell Programming Lab	PCC	Lab	0	0	3	3	1.5
201SO3L05 201SO3L06	**Skill Oriented Course-I** Applications of python-numpy Web Application Development using Full Stack Frontend Development–Module–I	SC	Lab	0	0	4	4	2
201MC3T03	Biology for Engineers	MC	Theory	2	0	0	0	0
TOTAL				17	0	13	28	21.5

IV SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS4T16	Probability and statistics	BSC	Theory	3	0	0	3	3
201CS4T05	Formal Languages and Automata Theory	PCC	Theory	3	0	0	3	3
201CS4T06	Database Management Systems	PCC	Theory	3	0	0	3	3
201CS4T07	Java programming	PCC	Theory	3	0	0	3	3
201HS4T03	Managerial Economics and Financial Analysis	HSMC	Theory	3	0	0	3	3
201CS4L04	Database Management Systems Lab	PCC	Lab	0	0	3	3	1.5
201CS4L05	Java Programming Lab	PCC	Lab	0	0	3	3	1.5
201CS4L06	R Programming Lab	PCC	Lab	0	0	3	3	1.5
201SC4L18 201SC4L19	**Skill Oriented Course-II** Applications of python-pandas Web Application Development using Full Stack Frontend Development-Module-II	SC	Lab	0	0	4	4	2
201MC4T04	Essence of Indian Traditional Knowledge	MC	Theory	2	0	0	0	0
TOTAL				17	0	13	28	21.5
Honors/Minor courses				3	1	0	4	4

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V SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits(C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
191CS5T08	Compiler Design	PCC	3	0	0	3	3
191CS5T09	Computer Networks	PCC	3	0	0	3	3
191CS5T10	Database Management Systems	PCC	3	0	0	3	3
191CS5T11	Operating Systems	PCC	3	0	0	3	3
----	Professional Elective -I	PEC	3	0	0	3	3
----	Open Elective -I	OEC	3	0	0	3	3
191CS5L04	Operating Systems and Computer Networks Lab	PCC	0	0	3	3	1.5
191CS5L05	Database Management Systems Lab	PCC	0	0	2	2	1
191HS5T06	Employability Skills - III	HSMC	0	0	2	2	1
191PR5P02	Socially Relevant Project	PROJ	0	0	2	2	1
191MC5A08	Intellectual Property Rights and Patents	MC	2	0	0	2	0
		TOTAL	**20**	**0**	**9**	**29**	**22.5**

VI SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
191CS6T12	Data Ware Housing and Data Mining	PCC	3	0	0	3	3
191CS6T13	Object Oriented Analysis and Design	PCC	3	0	0	3	3
191CS6T14	Web Technologies	PCC	3	0	0	3	3
----	Professional Elective-II	PEC	3	0	0	3	3
----	Professional Elective-III	PEC	3	0	0	3	3
----	Open Elective-II	OEC	3	0	0	3	3
191CS6L06	Data Mining and Object Oriented Analysis and Design Lab	PCC	0	0	3	3	1.5
191CS6L07	Web Technologies Lab	PCC	0	0	3	3	1.5
191HS6T07	Employability Skills - IV	HSMC	0	0	2	2	1
191MC6A09	Professional Ethics and Human Values	MC	2	0	0	2	0
		TOTAL	**20**	**0**	**8**	**28**	**22**

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PROFESSIONAL ELECTIVES

Professional Elective – I (V Semester)			Professional Elective – II (VI Semester)		
S.No	Course Code	Name of the Course	S.No	Course Code	Name of the Course
1	191CS5E04	Functional and Logic Programming	1	191CS6E09	Scripting languages
2	191CS5E01	Advanced Computer Architecture	2	191CS6E06	Advanced Operating Systems
3	191CS5E02	Artificial Intelligence	3	191CS6E08	Machine Learning
4	191CS5E05	Software Requirement and Estimation	4	191CS6E10	Software Testing Methodologies
5	191CS5E03	Computer Graphics	5	191CS6E07	Image Processing
Professional Elective – III (VI Semester)			**Professional Elective – IV (VII Semester)**		
S.No	Course Code	Name of the Course	S.No	Course Code	Name of the Course
1	191CS6E11	C# .Net	1	191CS7E19	Middleware Technologies
2	191CS6E13	Distributed Systems	2	191CS7E17	Embedded Systems
3	191CS6E14	Natural Language Processing	3	191CS7E16	Data Analytics
4	191CS6E15	Software Quality Assurance	4	191CS7E20	Software Configuration Management
5	191CS6E12	Cloud Computing	5	191CS7E18	Human Computer Interaction
Professional Elective – V (VII Semester)			**Professional Elective – VI (VIII Semester)**		
S.No	Course Code	Name of the Course	S.No	Course Code	Name of the Course
1	191CS7E22	Design Patterns	1	191CS8E26	Block chain Architecture Design and Use cases
2	191CS7E23	Fault Tolerant Computing	2	191CS8E29	Real Time Operating Systems
3	191CS7E24	No SQL databases	3	191CS8E28	Deep Learning
4	191CS7E21	Agile Methodologies (Using Devops)	4	191CS8E30	Software Project Management
5	191CS7E25	Parallel Computing	5	191CS8E27	Cyber Security

PROFESSIONAL ELECTIVE

Track		Professional Elective I	Professional Elective II	Professional Elective III	Professional Elective IV	Professional Elective V	Professional Elective VI
Track 1	Programming languages	Functional and Logic Programming	Scripting languages	C# .Net	Middleware Technologies	Design Patterns	Block chain Architecture Design and Use cases
Track 2	Systems	Advanced Computer Architecture	Advance Operating Systems	Distributed Systems	Embedded Systems	Fault Tolerant Computing	Real Time Operating Systems
Track 3	Data Science and Machine Intelligence	Artificial Intelligence	Machine Learning	Natural Language Processing	Data Analytics	No SQL databases	Deep Learning
Track 4	Software Systems Engineering	Software Requirement and Estimation	Software Testing Methodologies	Software Quality Assurance	Software Configuration Management	Agile Methodologies (Using Devops)	Software Project Management
Track 5	Applications/ Generic	Computer Graphics	Image Processing	Cloud Computing	Human Computer Interaction	Parallel Computing	Cyber Security

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Note : Open Elective Course (OEC) must be selected from the list of Open Elective Courses offered by Other Department(s) only.

OPEN ELECTIVE – I (V Semester)

S. No	Course Code	Course Name	Offered By Department
1	191CE5O01	Basic Concrete Technology	CE
2	191EE5O01	Electrical Safety	EEE
3	191EE5O02	Electrical Materials	EEE
4	191EE5O03	Basic Electrical Measurements	EEE
5	191ME5O01	Renewable Energy Sources	ME
6	191ME5O02	Fundamentals of Mechanical Engineering	ME
7	191ME5O03	Supply Chain Management	ME
8	191ME5O04	3D Printing	ME
9	191ME5O05	Entrepreneurship Development and Incubation	ME
10	191EC5O01	Signals and Systems	ECE
11	191EC5O02	Digital Electronics and Logic Design	ECE
12	191EC5O03	Semi conductor devices	ECE
13	191CS5O01	Data Structures	CSE
14	191CS5O02	Object Oriented Programming through C++	CSE
15	191CS5O03	Java Programming	CSE
16	191CS5O04	R Programming	CSE
17	191IT5O01	Database Management Systems	IT
18	191IT5O02	Computer Graphics	IT
19	191MI5O01	Overview of Mining	Min.E
20	191PT5O01	Process Intensification in Petroleum Industry	PT
21	191PT5O02	Fundamentals of Petroleum Industry	PT
22	191AG5O01	Basic Crop Production Practices	Ag.E

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OPEN ELECTIVE – II (VI Semester)

S. No	Course Code	Course Name	Offered By Department
1	191CE6O02	Disaster Management	CE
2	191EE6O04	Energy Audit and Conservation Management	EEE
3	.191EE6O05	Non-Conventional Energy Sources	EEE
4	191EE6O06	Instrumentation	EEE
5	191ME6O06	Solar Energy Utilisation	ME
6	191ME6O07	Basic Thermodynamics and Heat Transfer	ME
7	191ME6O08	Introduction to Hydraulics and Pneumatics	ME
8	191ME6O09	3D Printing	ME
9	191ME6O10	Robotics	ME
10	191ME6O11	Management Science	ME
11	191ME6O12	Entrepreneurship Development and Incubation	ME
12	191EC6O04	Biomedical Instrumentation	ECE
13	191EC6O05	ECAD Tools	ECE
14	191CS6O05	Python Programming	CSE
15	191CS6O06	Operating Systems	CSE
16	191CS6O07	Web Technologies	CSE
17	191CS6O08	Cyber Security	CSE
18	191CS6O09	AR / VR	CSE
19	191IT6O03	Computer Organization	IT
20	191IT6O04	AI Tools & Techniques	IT
21	191IT6O05	Robotic Process Automation	IT
22	191MI6O02	Industrial Safety Practices	Min.E
23	191MI6O03	Electrical Equipment in Mines	Min.E
24	191PT6O03	Unconventional Hydrocarbon Resources	PT
25	191PT6O04	Asset Management	PT
26	191AG6O02	Weather forecast in Agriculture	Ag.E
27	191AG6O03	Bio-energy systems design and applications	Ag.E

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VII SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
171CS7T18	Cryptography and Network Security	PC	3	1	---	4	3
171CS7T19	UML and Design Patterns	PC	3	1	---	4	3
171CS7T20	Cloud Computing	PC	3	1	---	4	3
171HS7T05	Management Science	HSS	3	1	---	4	3
---	**Professional Elective - IV**	PE	3	1	---	4	3
---	**Professional Elective - V**	PE	3	1	---	4	3
171CS7L12	UML and Design Patterns Lab	PC	---	---	3	3	2
171CS7L13	Big Data Analytics Lab	PC	---	---	3	3	2
171CS7P01	Industry Oriented (Internship) Minor Project	PR	---	---	---	-	1
		TOTAL	18	6	6	30	23

VIII SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
---	**Professional Elective - VI**	PE	3	1	---	4	3
---	**Open Elective**	OE	3	1	---	4	3
171CS8P02	**Project Work**	PR	----	----	---	--	14
		TOTAL	6	2	0	8	20

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Professional Elective – I (V Semester)

S.No	Course Code	Name of the Course
1	171CS5E01	Unix and Shell Programming
2	171CS5E02	Advanced Computer Architecture
3	171CS5E03	Computer Graphics
4	171CS5E04	Software Testing Methodologies

Professional Elective – II (VI Semester)

S.No	Course Code	Name of the Course
1	171CS6E05	Software Quality Assurance
2	171CS6E06	Bio Informatics
3	171CS6E07	Human Computer Interaction
4	171CS6E08	Social Networks and Semantic Web

Professional Elective – III (VI Semester)

S.No	Course Code	Name of the Course
1	171CS6E09	Pattern Recognition
2	171CS6E10	Parallel Computing
3	171CS6E11	Storage Area Networks
4	171CS6E12	E - Commerce

Professional Elective – IV (VII Semester)

S.No	Course Code	Name of the Course
1	171CS7E13	Software Project Management
2	171CS7E14	Big Data Analytics
3	171CS7E15	Image Processing
4	171CS7E16	Cyber Laws

Professional Elective – V (VII Semester)

S.No	Course Code	Name of the Course
1	171CS7E17	Middleware Technologies
2	171CS7E18	Artificial Intelligence and Machine Learning
3	171CS7E19	Information Retrieval Systems
4	171CS7E20	Mobile Computing

Professional Elective – VI (VIII Semester)

S.No	Course Code	Name of the Course
1	171CS8E21	Agile Methodologies
2	171CS8E22	Cyber Security
3	171CS8E23	Distributed Databases
4	171CS8E24	Distributed Systems

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Open Elective (VIII Semester)

S.No	CourseCode	Name of the Course
1	171CS8O01	Microprocessor and Multi Core Systems
2	171CS8O02	Embedded Systems
3	171CS8O03	Soft Computing
4	171EE8O05	Robotics
5	171CS8O04	Operations Research
6	171CS8O05	Optical Communications
7	171EE8O07	Internet of Things
8	171EC8O02	Disaster Management
9	171CS8O06	Renewable Energy sources
10	171CS8O07	Nano Technology and its Applications

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ADVANCED DATA STRUCTURES
Common to CSE&IT

III Semester
Course Code:201CS3T01

L	T	P	C
3	0	0	3

Course Outcomes:

At the end of the Course, Student will be able to:

CO1: Demonstrate the External Sorting and Hashing.
CO2: Illustrate the concepts of Priority Queues.
CO3: AnalyzetheEfficient Binary Search trees and Multiway Search Trees.
CO4: Compare the Digital Search Structures.
CO5: Apply the String Matching Algorithms to real time applications.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	1	2	-	-	-	-	-	-	-
CO2	2	2	-	2	3	-	-	-	-	-	-	-
CO3	3	1	-	1	2	-	-	-	-	-	-	-
CO4	3	2	-	2	2	-	-	-	-	-	-	-
CO5	2	1	-	2	3	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit - I
External Sorting: Introduction, K-way Merge Sort, Buffer Handling for parallel Operation, Run Generation, Optimal Merging of Runs, Huffman Tree.
Hashing: Introduction to Static Hashing, Hash Tables, Hash Functions, Different Hash Functions, Collision Resolution Techniques, Dynamic Hashing.

Unit – II
Priority Queues (Heaps): Introduction, Binary Heaps-Model and Simple Implementation, Basic Heap Operations, Other Heap Operations, Applications of Priority Queues, Binomial Heaps (or Queues), Binomial Heap Structure and Implementation, Binomial Queue Operations.

Unit – III
Efficient Binary Search Trees: Self-balancing Binary Search Tree, AVL Trees, Rotations-LL, RR, LR and RL, Searching, Insertion, Deletion operations on AVL Trees, Red-Black Tree, Properties and Representation of Red-Black Trees, Insertion and deletion operations on Red-Black Trees, Applications of Red-Black Trees

Unit – IV
Multiway Search Trees: M-Way Search Trees Definition and Properties, B-Tree Definition and Properties, Searching, Insertion and Deletion operations on B-Trees, B+ Tree, Insertion and Deletion operations on B+ Trees.
Digital Search Structures: Introduction to Digital Search Tree, Operations on Digital Search Trees- Insertion, Searching, and Deletion.

Unit – V

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Digital Search Structures: Binary Tries, Compressed Binary Trie, Patricia, Searching Patricia, inserting into Patricia, delete a node from Patricia, Multiway Tries- Definition, Searching a Trie, Compressed Tries, Compressed Tries with Digit Numbers-Searching, Insertion, Deletion.
String Processing: String Operations, Brute-Force Pattern Matching, The BoyerMoore Algorithm, The Knuth-Morris-Pratt Algorithm, The Longest Common Subsequence Problem (LCS).

Text Books:

1. Advanced Data Structures, ReemaThareja, S. Rama Sree, Oxford University Press.
2. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, Second Edition, Pearson.

Reference Books:

1. Fundamentals Of Data Structures In C, Horowitz, Sahni, Anderson-Freed, Second edition
2. Data Structures and Algorithms, A. V. Aho, J. E. Hopcroft, and J. D. Ullman, Pearson.
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, Third Edition, The MIT Press.
4. Advanced Data Structures, Peter Brass, Cambridge University Press.

Web Links:

1. https://ocw.mit.edu/courses/...and...data-structures...notes/MIT6_851S12_L1.
2. http://nptel.ac.in/courses/106103069/26
3. https://csd.cs.cmu.edu/course-profiles/15-121-Introduction-to-Data-Structures
4. https://www.cs.purdue.edu/cgvlab/courses/251/lectures/slides/04.03-Pattern atching AndTries.pdf
5. https://www.csie.ntu.edu.tw/~ds/ppt/ch5/chapter5.PPT

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OPERATING SYSTEMS
Common to CSE&IT

III Semester
Course Code:201CS3T03

L	T	P	C
3	0	0	3

Course Outcomes:

At the end of the Course, Student will be able to:

CO1: Illustrate the basic structure, services, system calls and architectural components of Operating Systems.
CO2: Analyze various Process Scheduling algorithms and Multi threading models.
CO3: Demonstrate Inter Process Communication between the processes and deadlocks.
CO4: Make use of paging, segmentation and virtual memory strategies to allocate memory for the process.
CO5: Describe the concepts of file system implementation, disk management, Protection and security for system.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	-
CO2	2	3	2	1	-	-	-	-	-	-	-	-
CO3	1	2	3	1	-	-	-	-	-	-	-	-
CO4	1	1	1	3	-	-	-	-	-	-	-	-
CO5	1	1	3	1	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	3	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit - I

Operating Systems Overview: Operating system functions, Operating system structure, Operating systems operations, Computing environments, Open-Source Operating Systems.

System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, System Boot.

Unit – II

Process Concept: Process scheduling, Operations on processes, Inter-process communication.

Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling.

Multithreaded Programming: Multithreading models, Thread libraries, Threading issues.

Unit – III

Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Classical IPC Problems - Dining philosophers problem, Readers and writers problem.

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention.

Unit – IV

Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation.

Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation.

File Systems: Files, Directories, File system implementation, management and optimization.

Unit – V

Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights.

System Security: Introduction, Program threats, System and network threats.

Case Studies: Linux, Microsoft Windows.

Text Books:

1. Operating System Concepts, Abraham Silberschatz, Peter B Galvin and Greg Gagne,9th Edition, John Wiley and Sons Inc., 2013.
2. Modern Operating Systems, Tanenbaum A S, 3rd edition, Pearson Education, 2008.

Reference Books:

1. Operating Systems A Concept Based Approach, Dhamdhere D M, 3rd edition, Tata McGraw-Hill, 2012.
2. Operating Systems -Internals and Design Principles, Stallings W, 6th edition, Pearson Education, 2009.
3. Operating Systems, Nutt G, 3rd edition, Pearson Education, 2004.

Web Links:

1. http://nptel.ac.in/downloads/106108101/
2. https://www.coursera.org/learn/iot/lecture/MrgxS/lecture-3-1-operating-systems.
3. http://www.geeksforgeeks.org/operating-systems/
4. https://in.udacity.com/auth?next=/course/introduction-to-operating-systems--ud923

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SOFTWARE ENGINEERING
Common to CSE&IT

III Semester
Course Code:201CS3T04

L	T	P	C
3	0	0	3

Course Outcomes:

At the end of the Course, Student will be able to:

CO1: Explain the key facts, concepts, principles, and theories of software & Software Engineering.
CO2: Compare various software development process models with respective to advantages, disadvantages and applicability.
CO3: Describe the various responsibilities and activities of Software Project Management.
CO4: Prepare SRS Document for any real time scenario.
CO5: Apply various Designs, Coding and testing Principles for developing the software products.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	-	-	2	-
CO2	2	3	2	-	-	-	-	-	-	-	2	-
CO3	2	2	2	-	-	-	-	-	-	-	3	-
CO4	2	3	3	-	-	-	-	-	1	-	2	-
CO5	2	2	3	-	-	-	-	-	-	-	2	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	-	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit - I

Introduction to Software Engineering: The Nature of Software, The Unique Nature of WebApps, Software Engineering, The Software Process, Software Engineering Practice,Software Myths.

Software Process: Software Process, Process Classification, Phased Development Life Cycle, Software Development Process Models – Waterfall Model, Iterative Waterfall Model, Prototype Model, Incremental Model, Spiral Model, Agile Process Model and RUP process Model.

Case Study: Survey on different process models including.
i.Advantages and Disadvantages of
the models.
ii. Applicability of the model.
iii.Projects developed using various models.

Unit – II

Software Project Management: Project Management Essentials, What is Project Management, Software Configuration Management, Risk management.

Project Planning and Estimation: Project Planning Activities, Software Metrics and Measurements, Project Size Estimation, Effort Estimation Techniques.

Case Study: Estimate the effort of the software development using Functional Points and COCOMO Model for any real time problem.

Unit – III

Requirements Engineering: Software Requirements, Requirements Engineering Process, Requirements Elicitation and Analysis, Requirements Specification, Requirements Validation, Requirements Management.
Case Study: Create a SRS document for any one of the following Software F.ojects.
1. Course Registration System
2. Students Marks Analyzing System
3. Online Ticket Reservation System
4. Stock Maintenance

Unit – IV
Software Design: Software Design Process, Characteristics of Good Software Design, Design Principles, Modular Design, Software Architecture, Design Methodologies,
Implementation: Coding Principles, Coding Process, Code Verification, and Code Documentation.
Case Study: Construct the DFD and CFD for any one of the following Software Projects.
1. Airline Reservation System
2. Students Marks Analyzing System
3. ATM System
4. Library Management System

Unit – V
Software Testing: Testing Fundamentals, Test Planning, Black-Box Testing, WhiteBox Testing, Levels of Testing, Usability Testing, Regression Testing, Debugging Approaches.
Software Quality and Reliability: Software Quality factors, Verification & Validation, Software Quality Assurance, The Capability Maturity Model, and Software Reliability.
Case Study: Design the test cases for any one of the following real time scenarios using White Box & Black Box Testing Techniques.
1. E-Commerce application (Flipkart, Amazon) 2. Mobile Application

Text Books:

1. Software Engineering – Concepts and Practices: Ugrasen Suman, Cengage Learning.
2. Software Engineering: A practitioner's approach, Roger S. Pressman, McGrawHill.

Reference Books:

1. Software Engineering, Lan Sommerville, Ninth Edition, Pearson
2. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India
3. Fundamentals of Software Engineering, Rajib Mall, Prentice Hall India.
4. Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill.
5. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

Web Links:

1. https://www.tutorialspoint.com/software_engineering/
2. http://nptel.ac.in/courses/106/105/106105182/
3. https://www.coursera.org/learn/software-processes-and-agile-practices
4. http://www.geeksforgeeks.org/software-engineering-gq/
5. https://www.coursera.org/browse/computer-science/software-development

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WEB TECHNOLOGIES
Common to CSE & IT

VI Semester
Course Code:191CS6T14

L	T	P	C
3	0	0	3

Course Outcomes:

At the end of the Course, Student will be able to:

CO1:. Develop static web pages using HTML and CSS.
CO2: Apply JavaScript for Client side validations and Node.JS to learn server side applications using JavaScript.
CO3: Make use of Angular JS for developing dynamic and responsive web pages.
CO4: Utilize React JS for developing dynamic and responsive web pages.
CO5: Create and deploy secure, usable database driven web applications using PHP and MySQL/MongoDB.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	3	-	-	-	-	-	-	-	-	2
CO2	-	2	2	-	2	-	-	-	-	-	-	3
CO3	-	2	3	-	2	-	-	-	-	-	-	2
CO4	-	3	2	-	-	-	-	-	-	-	-	2
CO5	-	-	2	-	3	-	-	-	-	-	-	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	3	-
CO3	2	-
CO4	2	-
CO5	3	-

Unit - I
HTML, HTML5, CSS, CSS3 HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, HTML styles, Elements, Attributes, Heading, Layouts, HTML Media, Iframes, Images, Links, Lists,Tables, Forms, GET and POST method, HTML 5, Dynamic HTML. CSS: Cascading style sheets, Levels of Style Sheets, Style Specification Formats, Selector Forms, Box Model, Conflict Resolution, CSS3.

Unit – II
JavaScript & XML Javascript - Introduction, Primitives, Variables – var, let, const, Operations and Expressions,Control Statements, Functions, Objects (Predefined - String, Number, Array, Date, Math,Random, RegExp, User Defined – Definition, Properties, Methods, Display, Accessors,Constructors), Events, Pattern Matching using Regular Expressions,Working with XML: Document type Definition (DTD), XML schemas, XSLT, XML and CSS, Document object model, Parsers - DOM and SAX.

Unit – III
Node JS & Angular JS Node.js- Introduction, Advantages, Process Model, Modules, HTTP Module, File system,URL module, NPM, Events, Upload Files, Email.Angular JS – Introduction, Expressions, Modules, Directives, Model, Data Binding,Controllers, Scopes, Filters, Services, HTTP, Tables, Select, Events, Forms, Validation, API,W3.CSS, Includes, Routing, SQL, DOM, Application.

Unit – IV

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React JS React JS – Introduction, Displaying "Welcome React", Introducing JSX, Rendering Elements, Components and Props, State and Lifecycle, Handling Events, Conditional Rendering, Lists and Keys, Forms, Lifting State Up, Composition vs Inheritance, Thinking in React.

Unit – V

PHP PHP Programming - Introduction, Creating and Running PHP Script. Variables, Constants,DataTypes, Operators. Controlling Program Flow - Conditional and Loop statements, Arrays,Functions, Client-Server Scripting – XAMPP/LAMP Introduction, Running PHP Script in XAMPP, Super Globals, Working with Form Data, Database Connectivity – MySQL Introduction using XAMPP in Command Mode and GUI, Working with MySQL Queries,Integrating PHP and MySQL to work with Form Data.No SQL Database - MongoDB Introduction, Create and Drop Database, Create and Drop Collection, Data Types, Insert, Query, Update, Delete, Integrating PHP with MongoDB.

Text Books:

1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson
2. Pro Mean Stack Development, 1st Edition, ELadElrom, Apress O'Reilly.
3. React Explained, 2020 Edition, Zac Gordon, OSTraining.
4. MongoDB – The Definitive Guide, 2nd Edition, Kristina Chodorow,O'Reilly.

Reference Books:

1. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book,1st Edition, Dream Tech.
2. An Introduction to Web Design, Programming, 1st Edition, Paul S Wang, Sanda S Katila, Cengage Learning.

Web Links:

1. https://www.reactjs.org/docs/getting-started.html
2. https://www.university.mongodb.com/

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SOFTWARE TESTING METHODOLOGIES
Professional Elective II
Common to CSE & IT

VI Semester
Course Code:191CS6E10

L	T	P	C
3	0	0	3

Course Outcomes:

At the end of the Course, Student will be able to:

CO1: Explain the fundamentals of software testing.
CO2: Summarize verification and validation activities.
CO3: Develop the test cases using different testing strategies.
CO4: Describe the concepts of Efficient Test Suite Management, Quality and Debugging.
CO5: Discuss about various Automation Testing tools.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	1	-	-	-	-	-	-	-
CO2	2	1	-	1	-	-	-	-	-	-	-	-
CO3	-	2.	3	-	1	-	-	-	-	-	-	-
CO4	3	-	-	1	-	-	-	-	-	-	-	-
CO5	2	2	-	-	3	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	2	-
CO4	1	-
CO5	1	-

Unit - I
Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, definition, Model for testing, Effective Vs. Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, Software Testing Methodology. Verification and Validation: Verification & Validation Activities, Verification, Verification of Requirements, High level and low level designs, verifying code, Validation.

Unit – II
Dynamic Testing-Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing White-Box Testing: need, Logic Coverage criteria, Basis Path testing, Graph matrices, Loop testing, data flow testing, mutation testing

Unit – III
Static Testing: Inspections, Structured Walkthroughs, Technical Reviews Validation activities: Unit testing, Integration Testing, Function testing, system testing, acceptance testing. Regression testing: Progressives Vs. regressive testing, Regression test ability, Objectives of regression testing, Regression testing types, Regression testing techniques.

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Unit – IV

Efficient Test Suite Management: growing nature of test suite, Minimizing the test suite and its benefits, test suite prioritization, Types of test case prioritization, prioritization techniques, measuring the effectiveness of a prioritized test suite. Software Quality Management: Software Quality metrics, SQ Amodels.

Unit – V

Automation and Testing Tools: need for automation, categorization of testing tools,

Text Books:

1. Software Testing, Principles and Practices, NareshChauhan,Oxford
2. Software Testing- YogeshSingh,CAMBRIDGE.

Reference Books:

1. Foundations of Software testing, Aditya P Mathur, 2ed,Pearson
2. Software Testing, Principles, techniques and Tools, M G Limaye,TMH
3. Effective Methods for Software testing, Willian E Perry, 3ed,Wiley

Web Links:

1. https://www.guru99.com/software-testing-lifecycle
2. http://www.softwaretestinghelp.com/what-is-verification-and-validation/
3. http://nptel.ac.in/courses/106105150/
4. http://www.cigniti.com/blog/top-3-regression-testing-types-how-to-execute
5. https://www.utest.com/search-result/tag/Tools

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IMAGE PROCESSING
Professional Elective II
Common to CSE & IT

VI Semester
Course Code:191CS6E07

L	T	P	C
3	0	0	3

Course Outcomes:

At the end of the Course, Student will be able to:

CO1: Discuss the fundamental concepts of a digital image processing system.
CO2: Demonstrate the fundamentals of color image models.
CO3: Analyze images in spatial and frequency domain using various transforms.
CO4: Evaluate the techniques for image restoration.
CO5: Interpret an image using different segmentation techniques.
CO6: Make use of different types of compression techniques in image data compression.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	-	-	-	-	-	-	-	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-
CO3	1	2	2	3	-	-	-	-	-	-	-	-
CO4	2	2	3	1	-	-	-	-	-	-	-	-
CO5	2	3	1	1	-	-	-	-	-	-	-	-
CO6	2	3	2	2	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	3	-
CO4	2	-
CO5	2	-
CO6	2	-

Unit - I

Introduction: Fundamentals Steps in Digital Image Processing, Components of an image processing system, Elements of Visual Perception ,Image Sensing and Acquisition ,Image Sampling and Quantization ,Relationships between pixels Color Image processing: Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

Unit – II

Image Enhancement: Spatial Domain: Gray level transformations , Histogram processing , Basics of Spatial Filtering, Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform, Smoothing and Sharpening frequency domain filters ,Ideal, Butterworth and Gaussian high pass filters, Homomorphic filtering.

Unit – III

Image Restoration: Image Restoration ,degradation model, Noise models, Mean Filters ,Order Statistic filters, Adaptive filters , Band reject Filters, Band pass Filters, Notch Filters ,Optimum Notch Filtering ,Inverse Filtering ,Wiener filterin

Unit – IV

Image Restoration: Image Restoration ,degradation model, Noise models, Mean Filters ,Order Statistic filters, Adaptive filters , Band reject Filters, Band pass Filters, Notch Filters ,Optimum Notch Filtering ,Inverse Filtering ,Wiener filterin

Unit – V

Image Compression and Recognition: Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors, Topological feature, Texture, Patterns and Pattern classes ,Recognition based on matching.

Text Books:

1. Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods, Third Edition, Pearson.
2. Fundamentals of Digital Image Processing, Anil K. Jain, Pearson.

Reference Books:

1. Digital Image Processing, Kenneth R. Castleman,Pearson
2. . Multidimensional Digital Signal Processing, D,E. Dudgeon and RM. Mersereau, Prentice Hall Professional Technical Reference.
3. Digital Image Processing,William K. Pratt, John Wiley, New York

Web Links:

1. http://nptel.ac.in/courses/117105079/
2. https://www.robotix.in/tutorial/imageprocessing/basiclp/
3. http://freevideolectures.com/Course/2316/Digital-Image-Processing-IIT-Kharagpur
4. https://www.cs.nmt.edu/~ip/lectures.html
5. http://nptel.ac.in/courses/117105135/

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Date: 31-08-2021

Department of Computer Science and Engineering

Syllabus revision Index 2021-2022

S.no	Course Name	Percentage change in Syllabus
1	Advanced Data Structures	50%
2	Operating Systems	55%
3	Software Engineering	25%
4	Web Technologies	50%
5	Software Testing Methodologies	60%
6	Image Processing	50%

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	**Pre-Revision**	**Post-Revision**
Course Title	Advanced Data Structures	Advanced Data Structures
Course Code	191CS3T03	201CS3T01
Syllabus	**UNIT-I:** Dictionaries and Hashing: Sets, Dictionaries, Hash Tables, Open Hashing, Closed Hashing (Rehashing Methods), Different Hash Functions(Division Method, Multiplication Method, Mid-Square Method, Folding Method), Secure Hash Functions, Collision Resolution Techniques - Open Addressing and Closed Addressing, Dynamic Hashing.	**UNIT-I:** External Sorting: Introduction, K-way Merge Sort, Buffer Handling for parallel Operation, Run Generation, Optimal Merging of Runs, Huffman Tree. Hashing: Introduction to Static Hashing, Hash Tables, Hash Functions, Different Hash Functions, Collision Resolution Techniques, Dynamic Hashing
	UNIT-II: Introduction to Non linear Data Structures: Trees: Introduction, Types of Trees, Creating a Binary tree, Traversing a Binary Tree, Applications of Binary Tree. Priority Queues: Introduction, Binary Heaps, Basic Heap Operations, Applications of Priority Queues.	**UNIT-II:** Priority Queues (Heaps): Introduction, Binary Heaps-Model and Simple Implementation, Basic Heap Operations, Other Heap Operations, Applications of Priority Queues, Binomial Heaps (or Queues), Binomial Heap Structure and Implementation, Binomial Queue Operations.
	UNIT-III: Efficient Binary Search Trees: Binary Search Trees, Operations on Binary Search Trees, Self- balancing Binary Search Trees, AVL Trees- Operations on AVL Trees Multi-way Search Trees: B-Trees, B+ Trees.	**UNIT-III:** Efficient Binary Search Trees: Self-balancing Binary Search Tree, AVL Trees, Rotations-LL, RR, LR and RL, Searching, Insertion, Deletion operations on AVL Trees, Red-Black Tree, Properties and Representation of Red-Black Trees, Insertion and deletion operations on Red-Black Trees, Applications of Red-Black Trees.
	UNIT-IV: Graphs: Graph Terminology, Representations of	**UNIT-IV:** Multiway Search Trees: M-Way Search Trees Definition and

	Graphs, Graph Traversal Algorithms, Minimum Cost Spanning Tree-Kruskal's and Prim's algorithms, Shortest Path Algorithm Dijkstr's Algorithm, Applications of Graphs.	Properties, B-Tree Definition and Properties, Searching, Insertion and Deletion operations on B-Trees, B+ Tree, Insertion and Deletion operations on B+ Trees. Digital Search Structures: Introduction to Digital Search Tree, Operations on Digital Search Trees-Insertion, Searching, and Deletion.
	UNIT-V: Pattern matching algorithms: The Boyer –Moore algorithm, The Knuth-Morris- Pratt algorithm Tries: Definition, Digital Search Tree-Operations on Digital Search Tree, Binary trie and Patricia. .	**UNIT**-V: Digital Search Structures: Binary Tries, Compressed Binary Trie, Patricia, Searching Patricia, inserting into Patricia, delete a node from Patricia, Multiway Tries- Definition, Searching a Trie, Compressed Tries, Compressed Tries with Digit Numbers-Searching, Insertion, Deletion. String Processing: String Operations, Brute-Force Pattern Matching, The BoyerMoore Algorithm, The Knuth-Morris-Pratt Algorithm, The Longest Common Subsequence Problem (LCS). .

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	**Pre-Revision**	**Post-Revision**
Course Title	Operating Systems	Operating Systems
Course Code	191CS5T11	201CS3T03
Syllabus	**UNIT-I:** Introduction to Operating System Concepts: What Operating System do, Operating System Structure, Operating System Operations, Process Management, Memory management, Storage Management, Protection and Security, Computing Environments, Open-Source Operating systems, Operating systems services, System call, Types of System call.	**UNIT-I:** Operating Systems Overview: Operating system functions, Operating system structure, Operating systems operations, Computing environments, Open-Source Operating Systems. System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, System Boot.
	UNIT-II: Process Management: Process Concept: The process, Process State, Process control block, Threads, Process Scheduling: Scheduling Queues, Schedulers, Context switch, Operations on Processes, Inter process Communication. Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms. Multithread Programming: Overview, Benefits, Multithreading Models.	**UNIT-II:** Process Concept: Process scheduling, Operations on processes, Inter-process communication. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues.
	UNIT-III: Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors. Deadlocks: System Model, Deadlock Characterization, Methods for handling Deadlock, Deadlock Prevention, Deadlock Avoidance,	**UNIT-III:** Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Classical IPC Problems - Dining philosophers problem, Readers and writers problem. Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm,

	Deadlock Detection, Recovery from Deadlock.	Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention.
	UNIT-IV: Memory Management: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table. Virtual Memory Management: Background, Demand Paging, Page Replacement, Thrashing.	**UNIT-IV:** Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation. File Systems: Files, Directories, File system implementation, management and optimization.
	UNIT-V: File System Interface: File concept, Access Methods, Directory and Disk structure, File system mounting, File sharing, protection. Implementing File-Systems: File system structure, File System implementation, Directory Implementation, allocation methods, free-space management. Mass-storage structure: Overview of Mass-storage structure, Disk scheduling. .	**UNIT**-V: Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation. System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats. Case Studies: Linux, Microsoft Windows. .

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Software Engineering	Software Engineering
Course Code	191CS3T01	201CS3T04
Syllabus	**UNIT-I:** Introduction to Software Engineering: Software, Software Crisis, Software Engineering Definition, Evolution of Software Engineering Methodologies, Software Engineering Challenges Software Process: Software Process, Process Classification, Phased Development Life Cycle, Software Development Process Models. Case Study: Survey on different process models including. i. Advantages and Disadvantages of the models. ii. Applicability of the model. iii. Projects developed using the various models.	**UNIT-I:** Introduction to Software Engineering: The Nature of Software, The Unique Nature of Web Apps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths. Software Process: Software Process, Process Classification, Phased Development Life Cycle, Software Development Process Models – Waterfall Model, Iterative Waterfall Model, Prototype Model, Incremental Model, Spiral Model, Agile Process Model and RUP process Model. Case Study: Survey on different process models including. i. Advantages and Disadvantages of the models. ii. Applicability of the model. iii. Projects developed using various models.
	UNIT-II: Software Project Management: Project Management Essentials, What is Project Management, Software Configuration Management, Risk management. Project Planning and Estimation: Project Planning Activities, Software Metrics and Measurements, Project Size Estimation, Effort Estimation Techniques. Case Study: Estimate the effort of the software development using Functional Points for the real time problem.	**UNIT-II:** Software Project Management: Project Management Essentials, What is Project Management, Software Configuration Management, Risk management. Project Planning and Estimation: Project Planning Activities, Software Metrics and Measurements, Project Size Estimation, Effort Estimation Techniques. Case Study: Estimate the effort of the software development using Functional Points and COCOMO Model for any one of the real time problem.

	UNIT-III: Software Design: Software Design Process, Characteristics of Good Software Design, Design Principles, Modular Design, Software Architecture, Design Methodologies, Implementation: Coding Principles, Coding Process, Code Verification, Code Documentation. Case Study: Construct the HLD and LLD using SRS created	**UNIT-III:** Requirements Engineering: Software Requirements, Requirements Engineering Process, Requirements Elicitation and Analysis, Requirements Specification, Requirements Validation, Requirements Management. Case Study: Create a SRS document for any one of the following Software Projects. 1) Course Registration System 2) Students Marks Analyzing System 3) Online Ticket Reservation System 4) Stock Maintenance
	UNIT-IV: Requirements Engineering: Software Requirements, Requirements Engineering Process, Requirements Elicitation and Analysis, Requirements Specification, Requirements Validation, Requirements Management, Case Study: Create a SRS document for a real time scenario.	**UNIT-IV:** Software Design: Software Design Process, Characteristics of Good Software Design, Design Principles, Modular Design, Software Architecture, Design Methodologies, Implementation: Coding Principles, Coding Process, CodeVerification, Code Documentation. Case Study: Construct the DFD and CFD for any one of the following Software Projects. 1) Airline Reservation System 2) Students Marks Analyzing System 3) ATM System 4) Library Management System
	UNIT-V: Software Testing: Testing Fundamentals, Test Planning, Black-Box Testing, White- Box Testing, Levels of Testing, Usability Testing, Regression Testing, Debugging Approaches. Software Quality and Reliability: Software Quality factors, Verification & Validation, Software Quality Assurance, The Capability Maturity Model, Software Reliability. Case Study: Write the test cases for the real time scenario considered using White Box & Black Box Testing Techniques. .	**UNIT**-V: Software Testing: Testing Fundamentals, Test Planning, Black-Box Testing, WhiteBox Testing, Levels of Testing, Usability Testing, Regression Testing, Debugging Approaches. Software Quality and Reliability: Software Quality factors, Verification & Validation, Software Quality Assurance, The Capability Maturity Model, Software Reliability. Case Study: Design the test cases for any one of the following real time scenarios using White Box & Black Box Testing Techniques. 1) E-Commerce application (Flipkart, Amazon) 2) Mobile Application

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Web Technologies	Web Technologies
Course Code	171CS6T16	191CS6T14
Syllabus	**UNIT-I:** HTML: Introducing HTML Document Structure, Working with Links, Images, Tables and Frames. Introduction to Forms and HTML Controls, Cascading Style Sheets. The Basics of JavaScript: Primitives, Operations, and Expressions, Screen Output and Keyboard Input, Control Statements, Arrays, Functions, Pattern Matching using Regular Expressions, Events and Event Handling.	**UNIT-I:** HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, HTML styles, Elements, Attributes, Heading, Layouts, HTML Media, Iframes, Images, Links, Lists, Tables, Forms, GET and POST method, HTML 5, Dynamic HTML. CSS: Cascading style sheets, Levels of Style Sheets, Style Specification Formats, Selector Forms, Box Model, Conflict Resolution, CSS3.
	UNIT-II: XML: Document type Definitions, XML Schemas, XSLT Style Sheets, Document Object Model, DOM and SAX Approaches	**UNIT-II:** Javascript - Introduction, Primitives, Variables – var, let, const, Operations and Expressions, Control Statements, Functions, Objects (Predefined - String, Number, Array, Date, Math, Random, RegExp, User Defined – Definition, Properties, Methods, Display, Accessors, Constructors), Events, Pattern Matching using Regular Expressions, Working with XML: Document type Definition (DTD), XML schemas, XSLT, XML and CSS, Document object model, Parsers - DOM and SAX.
	UNIT-III: PHP Programming: Introducing PHP: Creating PHP script, Running PHP Script, Working with variables and constants: Using variables, Using constants, Data types, Operators, Controlling program flow: Conditional Statements, Looping	**UNIT-III:** Node.js- Introduction, Advantages, Process Model, Modules, HTTP Module, File system, URL module, NPM, Events, Upload Files, Email. Angular JS – Introduction, Expressions, Modules, Directives, Model, Data Binding, Controllers,

	Statements, Working with Arrays, functions, Files, Directories, Working with forms and Databases: Tag and Form Elements, using PHP and MySQL. AJAX: A New Approach, Integrating PHP and AJAX.	Scopes, Filters, Services, HTTP, Tables, Select, Events, Forms, Validation, API, W3.CSS, Includes, Routing, SQL, DOM, Application.
	UNIT-IV: PERL: A Brief History of Perl, Perl Variables, Arithmetic and String Operators, Conditional Statements, Perl I/O, Perl Iterations, functions, The Perl CGI Module, Pattern Matching in Perl, Simple Page Search.	**UNIT-IV:** React JS – Introduction, Displaying "Welcome React", Introducing JSX, Rendering Elements, Components and Props, State and Lifecycle, Handling Events, Conditional Rendering, Lists and Keys, Forms, Lifting State Up, Composition vs Inheritance, Thinking in React.
	UNIT-V: Introduction to Ruby: Scalar Types and Their Operations, Simple Input and Output, Control Statements, Fundamentals of Arrays, Hashes, Methods, Classes, Blocks and Iterators, Pattern Matching. .	**UNIT**-V: PHP Programming - Introduction, Creating and Running PHP Script. Variables, Constants, DataTypes, Operators. Controlling Program Flow - Conditional and Loop statements, Arrays, Functions, Client-Server Scripting – XAMPP/LAMP Introduction, Running PHP Script in XAMPP, Super Globals, Working with Form Data, Database Connectivity – MySQL Introduction using XAMPP in Command Mode and GUI, Working with MySQL Queries, Integrating PHP and MySQL to work with Form Data. No SQL Database - MongoDB Introduction, Create and Drop Database, Create and Drop Collection, Data Types, Insert, Query, Update, Delete, Integrating PHP with MongoDB.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Software Testing Methodologies	Software Testing Methodologies
Course Code	171CS5E04	191CS6E10
Syllabus	**UNIT-I:** Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, Definition, Model for testing, Effective Vs Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, relate STLC to SDLC, Software Testing Methodology	**UNIT-I:** Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, definition, Model for testing, Effective Vs. Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, Software Testing Methodology. Verification and Validation: Verification & Validation Activities, Verification, Verification of Requirements, High level and low level designs, verifying code, Validation.
	UNIT-II: Verification and Validation: Verification & Validation Activities, Verification, Verification of Requirements, High level and low level designs, How to verify code, Validation. Dynamic Testing I: Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing.	**UNIT-II:** Dynamic Testing-Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing White-Box Testing: need, Logic Coverage criteria, Basis Path testing, Graph matrices, Loop testing, data flow testing, mutation testing.
	UNIT-III: Dynamic Testing II: White-Box Testing: need, Logic coverage criteria, Basis path testing, Graph matrices, Loop testing, data flow testing, mutation testing. Static Testing: Inspections, Structured Walkthroughs, Technical reviews.	**UNIT-III:** Static Testing: Inspections, Structured Walkthroughs, Technical Reviews Validation activities: Unit testing, Integration Testing, Function testing, system testing, acceptance testing. Regression testing: Progressives Vs. regressive testing, Regression test

		ability, Objectives of regression testing, Regression testing types, Regression testing techniques.
	UNIT-IV: Validation activities: Unit testing, Integration Testing, Function testing, system testing, acceptance testing. Regression testing: Progressives Vs regressive testing, Regression testability, Objectives of regression testing, When regression testing done?, Regression testing types, Regression testing techniques.	**UNIT-IV:** Efficient Test Suite Management: growing nature of test suite, Minimizing the test suite and its benefits, test suite prioritization, Types of test case prioritization, prioritization techniques, measuring the effectiveness of a prioritized test suite. Software Quality Management: Software Quality metrics, SQ Amodels. Debugging: process, techniques, correcting bugs.
	UNIT-V: Software Testing Tools: Introduction to Testing, need for Automated Testing, Taxonomy of Testing tools, Regression and performance Testing tools, Testing management tools, Source code testing tools, How to select a testing tool. Introduction to list of tools like Win runner, Load Runner, Jmeter, About Win Runner, Using Win runner, Mapping the GUI, Recording Test, working with Test, Enhancing Test, Checkpoints, Test Script Language, putting it all together, Running and Debugging Tests, Analyzing Results, Batch Tests, Rapid Test Script Wizard.	**UNIT**-V: Automation and Testing Tools: need for automation, categorization of testing tools, selection of testing tools, Cost incurred, Guidelines for automated testing, overview of some commercial testing tools such as Win Runner, Load Runner, Jmeter and JUnit. Test Automation using Selenium tool. .

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Image Processing	Image Processing
Course Code	171CS7E15	191CS6E07
Syllabus	**UNIT-I:** Introduction: Digital Image Processing, Examples of fields that use digital image processing, fundamental steps in digital image processing, components of image processing system. Digital Image Fundamentals: A simple image formation model, image sampling and quantization, basic relationships between pixels	**UNIT-I:** Introduction: Fundamentals Steps in Digital Image Processing, Components of an image processing system, Elements of Visual Perception ,Image Sensing and Acquisition ,Image Sampling and Quantization ,Relationships between pixels Color Image processing: Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.
	UNIT-II: Digital Image Properties: Metric and topological properties of Digital Images, Histogram, entropy, Visual Perception, Image Quality, Color perceived by humans, Color Spaces, Palette Images, color Constancy Color Images: Pixel brightness transformations, Local Preprocessing, image smoothing, Edge detectors, Robert Operators, Laplace, Prewitt, Sobel, Fri-chen, Canny Edge detection, Smoothing Spatial Filters, Sharpening Spatial Filters	**UNIT-II:** Image Enhancement: Spatial Domain: Gray level transformations , Histogram processing , Basics of Spatial Filtering, Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform, Smoothing and Sharpening frequency domain filters ,Ideal, Butterworth and Gaussian high pass filters, Homomorphic filtering. UNIT-III: Image Restoration: Image Restoration ,degradation model, Noise models, Mean Filters ,Order Statistic filters, Adaptive filters , Band reject Filters, Band pass Filters, Notch Filters ,Optimum Notch Filtering ,Inverse Filtering ,Wiener filtering.
	UNIT-III: Mathematical Morphology: Basic Mathematical Concepts, Binary dilation and Erosion, Opening and closing, Gray Scale	**UNIT-III:** Image Restoration: Image Restoration ,degradation model, Noise models, Mean Filters ,Order Statistic filters, Adaptive filters , Band reject

	dilation and erosion, Skeleton, Thinning , Thickening Ultimate erosion, Geodesic transformations, Morphology and reconstruction, Morphological Segmentation	Filters, Band pass Filters, Notch Filters ,Optimum Notch Filtering ,Inverse Filtering ,Wiener filtering.
	UNIT-IV: Segmentation: Threshold detection methods, Optimal Thresholding, Edge based Segmentation-Edge image thresholding, Edge relaxation, Border tracing, Hough Transforms, Region based segmentation: Region Merging Region Splitting, Splitting and Merging, Watershed Segmentation.	**UNIT-IV:** Image Segmentation: Edge detection, Edge linking via Hough transform, Thresholding ,Region based segmentation: Region growing, Region splitting and merging, Morphological processing: Erosion and dilation, Segmentation by morphological watersheds :basic concepts , Dam construction ,Watershed segmentation algorithm
	UNIT-V: Image Data Compression: Image data Properties, Discrete Image Transformations in data compression, Discrete Cosine and Wavelet Transforms, Types of DWT and merits; Predicative Compression methods, Hierarchical and Progressive Compression methods, Comparison of Compression methods, JPEG- MPEG Image Compression methods.	**UNIT**-V: Image Compression and Recognition: Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors, Topological feature, Texture, Patterns and Pattern classes ,Recognition based on matching.

Signature of the Course Coordinator

Signature of the HOD

ADITYA ENGINEERING COLLEGE

An Autonomous Institutuion

Approved by AICTE • Permanently Affiliated to JNTUK • Accredited by NAAC with 'A' Grade
Recognised by UGC under sections 2(f) and 12(B) of UGC Act, 1956
Aditya Nagar, ADB Road, Surampalem - 533437, Near Kakinada, E.G.Dt., Ph:99498 76662

Program Name : B.Tech. in Information Technology

Syllabus Revision for the Academic Year 2021-2022				
S.No	Semester	Course Code	Course Name	% of content revised for the existing year
1	I	201HS1T01	Communicative English	0
2	I	201BS1T01	Differential Equations and Linear Algebra	0
3	I	201BS1T04	Engineering Chemistry	0
4	I	201ES1T02	Programming for Problem Solving using C	0
5	I	201ES1I02	Computer Engineering Workshop	0
6	I	201HS1L01	Communicative English Lab	0
7	I	201BS1L03	Engineering Chemistry Lab	0
8	I	201ES1L02	Programming for Problem Solving using C Lab	0
9	I	201MC1T01	Environmental Science	0
10	II	201BS2T07	Numerical Methods and Complex Variables	0
11	II	201BS2T09	Applied Physics	0
12	II	201ES2T11	Computer Organization	0
13	II	201ES2T04	Python Programming	0
14	II	201ES2T07	Data Structures through C	0
15	II	201BS2L04	Applied Physics Lab	0
16	II	201ES2L06	Data Structures through C Lab	0
17	II	201ES2L14	Python Programming Lab	0
18	II	201MC2L01	Professional Communication Skills Lab	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
19	II	201MC2T02	Constitution of India	0
20	III	201CS3T01	Advanced data structures	50
21	III	201CS3T02	Object Oriented Programming through C++	0
22	III	201CS3T03	Operating Systems	55
23	III	201CS3T04	Software Engineering	25
24	III	201BS3T13	Discrete Mathematics	0
25	III	201CS3L01	Object Oriented Programming through C++ Lab	100
26	III	201CS3L02	Operating Systems Lab	0
27	III	201CS3L03	Unix and Shell Programming Lab	100
28	III	201SO3L05	Skill Oriented Course-I 1. Applications of Python numpy	100
29	III	201SO3L06	2. Web application development using full stack frontend development – module –I	100
30	III	201MC3T03	Biology for Engineers	0
31	IV	201BS4T16	Probability and statistics	0
32	IV	201CS4T05	Formal Languages and Automata Theory	0
33	IV	201CS4T06	Database Management Systems	0
34	IV	201CS4T07	JAVA PROGRAMMING	0
35	IV	201HS4T03	Managerial Economics and Financial Analysis	0
36	IV	201CS4L04	Database ManagementSystems Lab	0
37	IV	201CS4L05	Java Programming Lab	100
38	IV	201CS4L06	R Programming Lab	100
39	IV	201SC4L18	Skill Oriented Course II 1.Applications of python-pandas	100
40	IV	201SC4L19	2. Web application development using full stack frontend development module-II)	100

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
41	IV	201MC4T04	Essence of Indian Traditional Knowledge	0
42	V	191CS5T08	Compiler Design	0
43	V	191CS5T09	Computer Networks	0
44	V	191CS5T10	Database Management Systems	0
45	V	191CS5T11	Operating Systems	0
46	V	191CS5E04	Functional and Logic Programming	100
47	V	191CS5E01	Advanced Computer Architecture	0
48	V	191CS5E02	Artificial Intelligence	100
49	V	191CS5E05	Software Requirement and Estimation	100
50	V	191CS5E03	Computer Graphics	0
51	V	191CE5O01	Basic Concrete Technology	0
52	V	191EE5O01	Electrical Safety	0
53	V	191EE5O02	Electrical Materials	0
54	V	191EE5O03	Basic Electrical Measurements	0
55	V	191ME5O01	Renewable Energy Sources	0
56	V	191ME5O02	Fundamentals of Mechanical Engineering	0
57	V	191ME5O03	Supply Chain Management	0
58	V	191ME5O04	3D Printing	0
59	V	191ME5O05	Entrepreneurship Development and Incubation	0
60	V	191EC5O01	Signals & Systems	0
61	V	191EC5O02	Digital Electronics and Logic Design	0
62	V	191EC5O03	Semi conductor devices	0
63	V	191CS5O01	Data Structures	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
64	V	191CS5O02	Object Oriented Programming through C++	0
65	V	191CS5O03	Java Programming	0
66	V	191CS5O04	R Programming	0
67	V	191IT5O01	Data Base Management Systems	0
68	V	191IT5O02	Computer Graphics	0
69	V	191MI5O01	Overview of Mining	0
70	V	191PT5O01	Process Intensification in Petroleum Industry	0
71	V	191PT5O02	Fundamentals of Petroleum Industry	0
72	V	191AG5O01	Basic Crop Production Practices	0
73	V	191CS5L04	Operating Systems and Computer Networks Lab	100
74	V	191CS5L05	Database Management Systems Lab	0
75	V	191HS5T06	Employability Skills - III	0
76	V	191PR5P02	Socially Relevant Project	100
77	V	191MC5A08	Intellectual Property Rights and Patents	0
78	VI	191CS6T12	Data Ware Housing and Data Mining	0
79	VI	191CS6T13	Object Oriented Analysis of Design	100
80	VI	191CS6T14	Web Technologies	50
81	VI	191CS6E09	Scripting languages	100
82	VI	191CS6E06	Advance Operating Systems	100
83	VI	191CS6E08	Machine Learning	0
84	VI	191CS6E10	Software Testing Methodologies	60
85	VI	191CS6E07	Image Processing	50
86	VI	191CS6E11	C# .Net	100

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
87	VI	191CS6E13	Distributed Systems	100
88	VI	191CS6E14	Natural Language Processing	100
89	VI	191CS6E15	Software Quality Assurance	0
90	VI	191CS6E12	Cloud Computing	0
91	VI	191CE6O02	Disaster Management	0
92	VI	191EE6O04	Energy Audit and Conservation Management	0
93	VI	191EE6O05	Non Conventional Energy resources	0
94	VI	191EE6O06	Instrumentation	0
95	VI	191ME6O06	Solar Energy Utilisation	0
96	VI	191ME6O07	Basic Thermodynamics and Heat Transfer	0
97	VI	191ME6O08	Introduction to Hydraulics and Pneumatics	0
98	VI	191ME6O09	3D Printing	0
99	VI	191ME6O10	Robotics	0
100	VI	191EC6O04	Biomedical Instrumentation	0
101	VI	191EC6O05	ECAD Tools	0
102	VI	191ME6O11	Management Science	0
103	VI	191IT6O03	Computer Organization	0
104	VI	191CS6O05	Python Programming	0
105	VI	191CS6O06	Operating Systems	0
106	VI	191IT6O04	AI Tools & Techniques	100
107	VI	191CS6O07	Web Technologies	0
108	VI	191IT6O05	Robotic Process Automation	100
109	VI	191CS6O08	Cyber Security	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
110	VI	191CS6O09	AR / VR	0
111	VI	191MI6O02	Industrial Safety Practices	0
112	VI	191MI6O03	Electrical Equipment's in Mines	0
113	VI	191PT6O03	Unconventional Hydrocarbon Resources	0
114	VI	191PT6O04	Asset Management	0
115	VI	191AG6O02	Weather forecast in Agriculture	0
116	VI	191AG6O03	Bio-energy systems design and applications	0
117	VI	191ME6O12	Entrepreneurship Development and Incubation	0
118	VI	191CS6L06	Data Mining and Object Oriented Analysis of Design Lab	100
119	VI	191CS6L07	Web Technologies Lab	0
120	VI	191HS6T07	Employability Skills - IV	0
121	VI	191MC6A09	Professional Ethics and Human Values	0
122	VII	171CS7T18	Cryptography and Network Security	0
123	VII	171IT7T05	Big Data Analytics	0
124	VII	171CS7T20	Cloud Computing	0
125	VII	171IT7T06	Mobile Computing	0
126	VII	171CS7E13	Software Project Management	0
127	VII	171IT7E06	Machine Learning	0
128	VII	171CS7E15	Image Processing	0
129	VII	171CS7E16	Cyber Laws	0
130	VII	171CS7E19	Information Retrieval Systems	0
131	VII	171IT7E07	Human Computer Interaction	0
132	VII	171IT7E08	Distributed Systems	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
133	VII	171IT7E09	Decision Support System	0
134	VII	171IT7L04	Mobile Computing Lab	0
135	VII	171CS7L13	Big Data Analytics Lab	0
136	VII	171IT7P01	Industry Oriented (Internship) Minor Project	0
137	VIII	171CS8E21	Agile Methodologies	0
138	VIII	171CS8E22	Cyber Security	0
139	VIII	171CS8E23	Distributed Databases	0
140	VIII	171IT8E10	Pattern Recognition	0
141	VIII	171IT8O01	Management Information System	0
142	VIII	171CS8O01	Microprocessor and Multi Core Systems	0
143	VIII	171CS8O02	Embedded Systems	0
144	VIII	171IT8O02	Computer Vision	0
145	VIII	171EE8O05	Robotics	0
146	VIII	171CS8O04	Operations Research	0
147	VIII	171CS8O05	Optical Communications	0
148	VIII	171EE8O07	Internet of Things	0
149	VIII	171EC8O02	Disaster Management	0
150	VIII	171CS8O07	Nano Technology and its Applications	0
151	VIII	171IT8P02	Major Project	0
152	VIII	171EC8O02	Disaster Management	0
153	VIII	171CS8O06	Renewable Energy sources	0
154	VIII	171CS8O07	Nano Technology and its Applications	0
155	VIII	171CS8P02	Project Work	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
Total number of courses in the academic year 2021-2022				= 155
Number of courses having revision in syllabus content >/= 20% in the academic year 2021-2022				= 28
Percentage of syllabus revision carried out in the academic year 2021-2022 = (49/135)*100				= 18.06%

Program Coordinator

Head of the Department

Head of the Department
Department of IT
Aditya Engineering College

PROGRAM STRUCTURE

I SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201HS1T01	Communicative English	HSMC	Theory	3	0	0	3	3
201BS1T01	Differential Equations and Linear algebra	BSC	Theory	3	0	0	3	3
201BS1T04	Engineering Chemistry	BSC	Theory	3	0	0	3	3
201ES1T02	Programming for Problem Solving using C	ESC	Theory	3	0	0	3	3
201ES1I02	Computer Engineering Workshop	ESC	Integrated	2	0	2	4	3
201HS1L01	Communicative English Lab	HSMC	Lab	0	0	3	3	1.5
201BS1L03	Engineering Chemistry Lab	BSC	Lab	0	0	3	3	1.5
201ES1L02	Programming for Problem Solving using C Lab	ESC	Lab	0	0	3	3	1.5
201MC1T01	Environmental Science	MC	Theory	2	0	0	2	0
			TOTAL	16	0	11	27	19.5

II SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS2T07	Numerical Methods and Complex Variables	BSC	Theory	3	0	0	3	3
201BS2T09	Applied Physics	BSC	Theory	3	0	0	3	3
201ES2T11	Computer Organization	ESC	Theory	3	0	0	3	3
201ES2T04	Python Programming	ESC	Theory	3	0	0	3	3
201ES2T07	Data Structures through C	ESC	Theory	3	0	0	3	3
201BS2L04	Applied Physics Lab	BSC	Lab	0	0	3	3	1.5
201ES2L06	Data Structures through C Lab	ESC	Lab	0	0	3	3	1.5
201ES2L14	Python Programming Lab	ESC	Lab	0	0	3	3	1.5
201MC2L01	Professional Communication Skills Lab	MC	Lab	0	0	3	3	0
201MC2T02	Constitution of India	MC	Theory	2	0	0	2	0
			TOTAL	17	0	12	29	19.5

III SEMESTER

Course code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
201CS3T01	Advanced data structures	PCC	3	0	0	3	3
201CS3T02	Object Oriented Programming through C++	PCC	3	0	0	3	3
201CS3T03	Operating Systems	PCC	3	0	0	3	3
201CS3T04	Software Engineering	PCC	3	0	0	3	3
201BS3T13	Discrete Mathematics	BSC	3	0	0	3	3
201CS3L01	Object Oriented Programming through C++ Lab	PCC	0	0	3	3	1.5
201CS3L02	Operating Systems Lab	PCC	0	0	3	3	1.5
201CS3L03	Unix and Shell Programming Lab	PCC	0	0	3	3	1.5
	Skill Oriented Course-I	SC	0	0	4	4	2
201SC3L05	1. Applications of Python - numpy						
201SC3L06	2. Web application development using full stack frontend development – Module –I						
201MC3T03	Biology for Engineers	MC	2	0	0	0	0
		TOTAL	17	0	13	28	21.5

IV SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
201BS4T16	Probability and statistics	BSC	3	0	0	3	3
201CS4T05	Formal Languages and Automata Theory	PCC	3	0	0	3	3
201CS4T06	Database Management Systems	PCC	3	0	0	3	3
201CS4T07	Java programming	PCC	3	0	0	3	3
201HS4T03	Managerial Economics and Financial Analysis	HSMC	3	0	0	3	3
201CS4L04	Database Management Systems Lab	PCC	0	0	3	3	1.5
201CS4L05	Java Programming Lab	PCC	0	0	3	3	1.5
201CS4L06	R Programming Lab	PCC	0	0	3	3	1.5
	Skill Oriented Course-II	SC	0	0	4	4	2
201SC4L18 201SC4L19	1. Applications of python-pandas						
	2. Web application development using full stack frontend development -Module-II)						
201MC4T04	Essence of Indian Traditional Knowledge	MC	2	0	0	0	0
		TOTAL	17	0	13	28	21.5

V SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
191CS5T08	Compiler Design	PCC	3	0	0	3	3
191CS5T09	Computer Networks	PCC	3	0	0	3	3
191CS5T10	Database Management Systems	PCC	3	0	0	3	3
191CS5T11	Operating Systems	PCC	3	0	0	3	3
----	Professional Elective -I	PEC	3	0	0	3	3
----	Open Elective -I	OEC	3	0	0	3	3
191CS5L04	Operating Systems and Computer Networks Lab	PCC	0	0	3	3	1.5
191CS5L05	Database Management Systems Lab	PCC	0	0	2	2	1
191HS5T06	Employability Skills - III	HSMC	0	0	2	2	1
191PR5P02	Socially Relevant Project	PROJ	0	0	0	0	1
191MC5A08	Intellectual Property Rights and	MC	2	0	0	2	0

VI SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
191CS6T12	Data Ware Housing and Data Mining	PCC	3	0	0	3	3
191CS6T13	Object Oriented Analysis of Design	PCC	3	0	0	3	3
191CS6T14	Web Technologies	PCC	3	0	0	3	3
----	Professional Elective II	PEC	3	0	0	3	3
----	Professional Elective III	PEC	3	0	0	3	3
----	Open Elective II	OEC	3	0	0	3	3
191CS6L06	Data Mining and Object Oriented Analysis of Design Lab	PCC	0	0	3	3	1.5
191CS6L07	Web Technologies Lab	PCC	0	0	3	3	1.5
191HS6T07	Employability Skills - IV	HSMC	0	0	2	2	1
191MC6A09	Professional Ethics and Human Values	MC	2	0	0	2	0
		TOTAL	**18**	**0**	**8**	**26**	**22**

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VII SEMESTER

Course Code	Course Title	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
171CS7T18	Cryptography and Network Security	PC	3	1	---	4	3
171IT7T05	Big Data Analytics	PC	3	1	---	4	3
171CS7T20	Cloud Computing	PC	3	1	---	4	3
171IT7T06	Mobile Computing	PC	3	1	---	4	3
---	**Professional Elective – IV**	PE	3	1	---	4	3
---	**Professional Elective – V**	PE	3	1	---	4	3
171IT7L04	Mobile Computing Lab	PC	---	---	3	3	2
171CS7L13	Big Data Analytics Lab	PC	---	---	3	3	2
171IT7P01	Industry Oriented (Internship) Minor Project	PR	---	---	---	0	1
		Total	**18**	**6**	**6**	**30**	**23**

VIII SEMESTER

Course Code	Course Title	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
---	**Professional Elective – VI**	PE	3	1	---	4	3
---	**Open Elective**	OE	3	1	---	4	3
171IT8P02	**Major Project**	PR	---	---	---	0	14
		Total	**6**	**2**	**0**	**8**	**20**

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PROFESSIONAL ELECTIVES

S.No	Course Code	Name of the Course	S.No	Course Code	Name of the Course
Professional Elective – I (V Semester)			**Professional Elective – II (VI Semester)**		
1	191CS5E04	Functional and Logic Programming	1	191CS6E09	Scripting languages
2	191CS5E01	Advanced Computer Architecture	2	191CS6E06	Advanced Operating Systems
3	191CS5E02	Artificial Intelligence	3	191CS6E08	Machine Learning
4	191CS5E05	Software Requirement and Estimation	4	191CS6E10	Software Testing Methodologies
5	191CS5E03	Computer Graphics	5	191CS6E07	Image Processing
Professional Elective – III (VI Semester)			**Professional Elective – IV (VII Semester)**		
S.No	**Course Code**	**Name of the Course**	**S.No**	**Course Code**	**Name of the Course**
1	191CS6E11	C# .Net	1	191CS7E19	Middleware Technologies
2	191CS6E13	Distributed Systems	2	191CS7E17	Embedded Systems
3	191CS6E14	Natural Language Processing	3	191CS7E16	Data Analytics
4	191CS6E15	Software Quality Assurance	4	191CS7E20	Software Configuration Management
5	191CS6E12	Cloud Computing	5	191CS7E18	Human Computer Interaction
Professional Elective – V (VII Semester)			**Professional Elective – VI (VIII Semester)**		
S.No	**Course Code**	**Name of the Course**	**S.No**	**Course Code**	**Name of the Course**
1	191CS7E22	Design Patterns	1	191CS8E26	Block chain Architecture Design and Use cases
2	191CS7E23	Fault Tolerant Computing	2	191CS8E29	Real Time Operating Systems
3	191CS7E24	No SQL databases	3	191CS8E28	Deep Learning
4	191CS7E21	Agile Methodologies (Using Devops)	4	191CS8E30	Software Project Management
5	191CS7E25	Parallel Computing	5	191CS8E27	Cyber Security

PROFESSIONAL ELECTIVE

Track		Professional Elective I	Professional Elective II	Professional Elective III	Professional Elective IV	Professional Elective V	Professional Elective VI
Track 1	**Programming languages**	Functional and Logic Programming	Scripting languages	C# .Net	Middleware Technologies	Design Patterns	Block chain Architecture Design and Use cases
Track 2	**Systems**	Advanced Computer Architecture	Advance Operating Systems	Distributed Systems	Embedded Systems	Fault Tolerant Computing	Real Time Operating Systems
Track 3	**Data Science and Machine Intelligence**	Artificial Intelligence	Machine Learning	Natural Language Processing	Data Analytics	No SQL databases	Deep Learning
Track 4	**Software Systems Engineering**	Software Requirement and Estimation	Software Testing Methodologies	Software Quality Assurance	Software Configuration Management	Agile Methodologies (Using Devops)	Software Project Management
Track 5	**Applications/ Generic**	Computer Graphics	Image Processing	Cloud Computing	Human Computer Interaction	Parallel Computing	Cyber Security

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Note : Open Elective Course (OEC) must be selected from the list of Open Elective Courses offered by Other Department(s) only.

OPEN ELECTIVE – I (V Semester)

S. No	Course Code	Course Name	Offered By Department
1	191CE5O01	Basic Concrete Technology	CE
2	191EE5O01	Electrical Safety	EEE
3	191EE5O02	Electrical Materials	EEE
4	191EE5O03	Basic Electrical Measurements	EEE
5	191ME5O01	Renewable Energy Sources	ME
6	191ME5O02	Fundamentals of Mechanical Engineering	ME
7	191ME5O03	Supply Chain Management	ME
8	191ME5O04	3D Printing	ME
9	191ME5O05	Entrepreneurship Development and Incubation	ME
10	191EC5O01	Signals and Systems	ECE
11	191EC5O02	Digital Electronics and Logic Design	ECE
12	191EC5O03	Semi conductor devices	ECE
13	191CS5O01	Data Structures	CSE
14	191CS5O02	Object Oriented Programming through C++	CSE
15	191CS5O03	Java Programming	CSE
16	191CS5O04	R Programming	CSE
17	191IT5O01	Database Management Systems	IT
18	191IT5O02	Computer Graphics	IT
19	191MI5O01	Overview of Mining	Min.E
20	191PT5O01	Process Intensification in Petroleum Industry	PT
21	191PT5O02	Fundamentals of Petroleum Industry	PT
22	191AG5O01	Basic Crop Production Practices	Ag.E

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ADVANCED DATA STRUCTURES
(Common to CSE & IT)

IIISemester
Course Code:171CS3T04

L	T	P	C
3	1	0	3

Course Outcomes:
At the end of the Course, Student will be able to:

CO1: Describe the working principles of K-way Merge Sort.
CO2: Apply Hashing Techniques to solve data integrity problems.
CO3: Explain the various techniques to implement Priority Queues.
CO4: Compare various balanced search Trees.
CO5: Compare and contrast B and B+ trees.
CO6: Construct various kinds of Tries.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	-	-	-	-	-	-	-	-	-
CO2	1	2	-	3	-	-	-	-	-	-	-	-
CO3	2	2	-	2	-	-	-	-	-	-	-	-
CO4	3	-	1	1	-	-	-	-	-	-	-	-
CO5	2	1	1	-	-	-	-	-	-	-	-	-
CO6	3	-	1	-	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	1	-
CO3	1	-
CO4	2	-
CO5	2	-
CO6	1	-

Unit – I
External Sorting: Introduction, K-way Merge Sort, Buffer Handling for parallel Operation, Run Generation, Optimal Merging of Runs

Hashing: Introduction to Static Hashing, Hash Tables, Hash Functions, Different Hash Functions, Secure Hash Functions, Collision Resolution Techniques, Dynamic Hashing.

Unit – II
Priority Queues (Heaps): Introduction, Binary Heaps-Model and Simple Implementation, Basic Heap Operations, Other Heap Operations,Applications of Priority Queues, Binomial Heaps (or Queues), Binomial Heap Structure and Implementation, Binomial Queue Operations.

Unit – III
Efficient Binary Search Trees: Binary Search Trees, Optimal Binary Search Trees, Self-balancing Binary Search Trees, AVL Trees- Operations on AVL Trees, Red-Black Trees-

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Properties and Representation of Red-Black Trees, Operations on Red-Black Trees, Applications of Red-Black Trees.

Unit – IV

Multiway Search Trees: M-Way Search Trees-Definition and Properties, Searching an M-Way Search Tree, B-Trees-Definition and Properties, Number of Elements in a B-tree, Searching for an Element in a B-Tree, Inserting a New Element in a B-Tree, Deleting an Element from a B-Tree, B+ Trees - Searching a B+ Tree, Inserting a New Element in a B+ Tree, Deleting an Element from a B+ Tree.

Unit – V

Digital Search Structures: Introduction to Digital Search Tree, Operations on Digital Search Trees – Insertion, Searching, and Deletion, Binary Tries and Patricia- Binary Tries, Compressed Binary Trie, Patricia, Multiway Tries- Definition, Searching a Trie, Sampling Strategies, Insertion into a Trie, Deletion from a Trie, Keys with Different Length, Height of a Trie, Space Required and Alternative Node Structure, Prefix Search and Applications, Compressed Tries, Compressed Tries with Skip Fields, Compressed Tries with Labeled Edges, Space Required by a Compressed Tries.

Text Books:

1. Advanced Data Structures, Reema Thareja,S. Rama Sree,Oxford University Press,2017.
2. Fundamentals Of Data Structures In C, Horowitz, Sahni, Anderson-Freed,Second edition, 2008.

Reference Books:

1. Advanced Data Structures, Peter Brass, Cambridge University Press, 2008.
2. Data Structures and Algorithms, A. V. Aho, J. E. Hopcroft, and J. D. Ullman,Pearson,2002.
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, Third Edition, The MIT Press.
4. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, Second Edition, Pearson.

Web Links:

1. https://ocw.mit.edu/courses/...and...data structures...notes/MIT6_851S12_L1.pdf
2. http://nptel.ac.in/courses/106103069/26
3. https://csd.cs.cmu.edu/course-profiles/15-121-Introduction-to-Data-Structures
4. https://www.hackerearth.com/practice/notes/heaps-and-priority-queues/
5. http://web.stanford.edu/class/archive/cs/cs166/cs166.1146/lectures/09/Small09.pdf

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OPERATING SYSTEMS
(Common to CSE & IT)

VSemester	**L**	**T**	**P**	**C**
Course Code:171CS5T14	**3**	**1**	**0**	**3**

Course Outcomes: At the end of the Course, Student will be able to:

- CO1: Interpret the basic structure, services, system calls and architectural components of Operating Systems.
- CO2: Solve problems related to process scheduling, synchronization in unit and multi-processing systems.
- CO3: Explain the deadlock handling Mechanism in the processing System
- CO4: Summarize the concepts of Memory Management, Virtual Memory Management and Thrashing
- CO5: Describe the concepts of file system and mass storage structure.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	2	3	-	-	-	-	-	-	-	-
CO3	2	2	1	2	-	-	-	-	-	-	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-	-
CO5	2	2	2	2	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Unit – I

Introduction to Operating System Concepts: What Operating System do, Operating System Structure, Operating System Operations, Process Management, Memory management, Storage Management, Protection and Security, Computing Environments, Operating systems services, System call, Types of System call.

Unit – II

Process Management:

Process concept: The process, Process State, Process control block, Threads, Process Scheduling: Scheduling Queues, Schedulers, Context switch, Operations on Processes, Inter process Communication,

Multithread Programming: Overview, Benefits, Multithreading Models.

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms

Unit – III

Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.

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Deadlocks: System Model, Deadlock Characterization, Methods for handling Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Unit – IV

Memory Management: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.

Virtual Memory Management: Background, Demand Paging, Page Replacement, Thrashing.

Unit – V

File system Interface: File concept, Access Methods, Directory and Disk structure, File system mounting, File sharing, protection.

Implementing File-Systems: File system structure, File System implementation, Directory Implementation, allocation methods, free-space management.

Mass-storage structure: Overview of Mass-storage structure, Disk scheduling.

Text Books:

1. Operating System Concepts, Abraham Silberschatz, Peter B Galvin and Greg Gagne, 9th Edition, John Wiley and Sons Inc., 2016.
2. Operating Systems - Internals and Design Principles, William Stallings, 6th Edition, Prentice Hall.

Reference Books:

1. Modern Operating Systems, Andrew S. Tanenbaum, 2nd Edition, Addison Wesley.
2. Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata Mc Graw Hill Education, 1996.
3. Operating Systems: A Concept-Based Approach, D M Dhamdhere, 2nd Edition, Tata Mc Graw-Hill Education.

Web Links:

1. http://nptel.ac.in/downloads/106108101/
2. https://www.coursera.org/learn/iot/lecture/MrgxS/lecture-3-1-operating-systems
3. http://www.geeksforgeeks.org/operating-systems/
4. https://in.udacity.com/auth?next=/course/introduction-to-operating-systems--ud923

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7.2) Write a function dups to find all duplicates in the list.

7.3) Write a function unique to find all the unique elements of a list.

8) Functions - Problem Solving

8.1)Write a function cumulative_product to compute cumulative product of a list of numbers.

8.2)Write a function reverse to reverse a list, without using the reverse function.

8.3)Write a function to compute GCD and LCM of two numbers. Each function shouldn't exceed one line.

9) OOP

9.1) Implement a Python script to illustrate constructor.

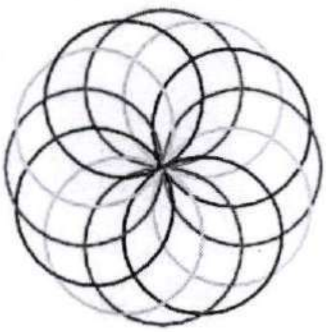
9.2) Implement a Python script on Class variables, instance variable and illustration of the self variable.

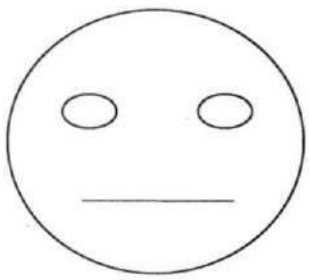
9.3) Implement a Python script to handle exceptions.

10) GUI, Graphics

10.1) Write a GUI for an Expression Calculator using tk.

10.2)Implement a Python script to implement the following figures using turtle





11) Files

11.1) Implement a Python script to print each line of a file in reverse order.

11.2) Implement a Python script to compute the number of characters, words and lines in a file.

12) Database Connectivity

Implement a Python script to

12.1) create table in database

12.2) insert record into a table in database

12.3) select records from the table in a database.

12.4) update data in a database table.

List of Augmented Experiments:
(Any 2 of the following experiments can be performed)

13) Guess the Number

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The Goal: This project uses the random module in Python. The program will first randomly generate a number unknown to the user. The user needs to guess what that number is. (In other words, the user needs to be able to input information.) If the user's guess is wrong, the program should return some sort of indication as to how wrong (e.g. The number is too high or too low). If the user guesses correctly, a positive indication should appear. You'll need functions to check if the user input is an actual number, to see the difference between the inputted number and the randomly generated numbers, and to then compare the numbers.

14)Hangman

The Goal: Despite the name, the actual "hangman" part isn't necessary. The main goal here is to create a sort of "guess the word" game. The user needs to be able to input letter guesses. A limit should also be set on how many guesses they can use. This means you'll need a way to grab a word to use for guessing. (This can be grabbed from a pre-made list. No need to get too fancy.) You will also need functions to check if the user has actually inputted a single letter, to check if the inputted letter is in the hidden word (and if it is, how many times it appears), to print letters, and a counter variable to limit guesses.

15)Write a program to find the greatest number that can be formed by using given set of numbers

16) Write a program to find sum of digits of a number till you get single digit sum.

Example:

Input :142 (Hint: 1+4+2=7)
Output :7
Input :4683 (Hint: 4+6+8+3=21 =>2+1=3)
Output :3

17) Write a program to count how many times each word present in a file

Reference Books:

1. Python for Everybody Exploring Data in Python 3, Charles Russell Severance, Sue Blumenberg.
2. Learning Python, Mark Lutz, Orielly.
3. Introduction to Python, Kenneth A. Lambert, Cengage.

Web Links:

1. https://www.hackerrank.com/
2. https://www.codechef.com/
3. https://www.topcoder.com/
4. https://code-cracker.github.io/

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WEB TECHNOLOGIES
Common to CSE & IT

VI Semester
Course Code:191CS6T14

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, Student will be able to:

CO1: Develop static web pages using HTML and CSS.
CO2: Apply JavaScript for Client side validations and Node.JS to learn server side applications using JavaScript.
CO3: Make use of Angular JS for developing dynamic and responsive web pages.
CO4: Utilize React JS for developing dynamic and responsive web pages.
CO5: Create and deploy secure, usable database driven web applications using PHP and MySQL/MongoDB.

Mapping of Course Outcomes with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	3	-	-	-	-	-	-	-	-	2
CO2	-	2	2	-	2	-	-	-	-	-	-	3
CO3	-	2	3	-	2	-	-	-	-	-	-	2
CO4	-	3	2	-	-	-	-	-	-	-	-	2
CO5	-	-	2	-	3	-	-	-	-	-	-	2

Mapping of Course Outcomes with Program Specific Outcomes:

	PSO1	PSO2
CO1	2	-
CO2	3	-
CO3	2	-
CO4	2	-
CO5	3	-

Unit - I
HTML, HTML5, CSS, CSS3 HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, HTML styles, Elements, Attributes, Heading, Layouts, HTML Media, Iframes, Images, Links, Lists,Tables, Forms, GET and POST method, HTML 5, Dynamic HTML. CSS: Cascading style sheets, Levels of Style Sheets, Style Specification Formats, Selector Forms, Box Model, Conflict Resolution, CSS3.

Unit – II
JavaScript & XML Javascript - Introduction, Primitives, Variables – var, let, const, Operations and Expressions,Control Statements, Functions, Objects (Predefined - String, Number, Array, Date, Math,Random, RegExp, User Defined – Definition, Properties, Methods, Display, Accessors,Constructors), Events, Pattern Matching using Regular Expressions,Working with XML: Document type Definition (DTD), XML schemas, XSLT, XML and CSS, Document object model, Parsers - DOM and SAX.

Unit – III
Node JS & Angular JS Node.js- Introduction, Advantages, Process Model, Modules, HTTP Module, File system,URL module, NPM, Events, Upload Files, Email.Angular JS – Introduction, Expressions, Modules, Directives, Model, Data Binding,Controllers, Scopes, Filters, Services, HTTP, Tables, Select, Events, Forms, Validation, API,W3.CSS, Includes, Routing, SQL, DOM, Application.

Unit – IV
React JS React JS – Introduction, Displaying "Welcome React", Introducing JSX, Rendering Elements, Components and Props, State and Lifecycle, Handling Events, Conditional Rendering, Lists and Keys, Forms, Lifting State Up, Composition vs Inheritance, Thinking in React.

Unit – V

PHP PHP Programming - Introduction, Creating and Running PHP Script. Variables, Constants,DataTypes, Operators. Controlling Program Flow - Conditional and Loop statements, Arrays,Functions, Client-Server Scripting – XAMPP/LAMP Introduction, Running PHP Script in XAMPP, Super Globals, Working with Form Data, Database Connectivity – MySQL Introduction using XAMPP in Command Mode and GUI, Working with MySQL Queries,Integrating PHP and MySQL to work with Form Data.No SQL Database - MongoDB Introduction, Create and Drop Database, Create and Drop Collection, Data Types, Insert, Query, Update, Delete, Integrating PHP with MongoDB.

Text Books:

1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson
2. Pro Mean Stack Development, 1st Edition, ELadElrom, Apress O'Reilly.
3. React Explained, 2020 Edition, Zac Gordon, OSTraining.
4. MongoDB – The Definitive Guide, 2nd Edition, Kristina Chodorow,O'Reilly.

Reference Books:

1. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book,1st Edition, Dream Tech.
2. An Introduction to Web Design, Programming, 1st Edition, Paul S Wang, Sanda S Katila, Cengage Learning.

Web Links:

1. https://www.reactjs.org/docs/getting-started.html
2. https://www.university.mongodb.com/

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SOFTWARE ENGINEERING
(Common to CSE & IT)

IVSemester **L T P C**
Course Code:171CS4T05 **3 1 0 3**

Course Outcomes:

At the end of the Course, Student will be able to:

CO1: Demonstrate an understanding of the key facts, concepts, principles and theories of software engineering.
CO2: Analyze the effective software engineering process, based on knowledge of widely used development lifecycle models. Also
CO3: Explain the various responsibilities and activities of project management.
CO4: Translate a requirements specification into an implementable design, following a structured and organized process.
CO5: Examine a testing strategy for a software system using different testing techniques.
CO6: Discuss about software reliability, quality management, software maintenance and reusability.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	-	-	-	-	-	-	-	-	-
CO2	2	2	3	2	-	-	-	-	-	-	-	-
CO3	3	-	1	-	-	-	-	-	-	-	-	-
CO4	1	2	2	3	-	-	-	-	-	-	-	-
CO5	2	2	3	-	-	-	-	-	-	-	-	-
CO6	3	1	-	1	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2
CO1	2	-
CO2	3	-
CO3	1	-
CO4	2	-
CO5	1	-
CO6	1	-

Unit – I

Introduction to Software Engineering: Software, Software Crisis, Software Engineering Definition, Evolution of Software Engineering Methodologies, Software Engineering Challenges.

Software Process: Software Process, Process Classification, Phased Development Life Cycle, Software Development Process Models.

Case Study: Survey on different process models including
i)Advantages and Disadvantages of the models
ii)Applicability of the model
iii)Projects developed using the various models

Unit – II

Software Project Management: Project Management Essentials, What is Project

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Management, Software Configuration Management, Risk management.
Project Planning and Estimation: Project Planning Activities, Software Metrics and Measurements, Project Size Estimation, Effort Estimation Techniques.
Case Study: Estimate the effort using function point analysis for a real time project

Unit – III
Requirements Engineering: Software Requirements, Requirements Engineering Process, Requirements Elicitation and Analysis, Requirements Specification, Requirements Validation, Requirements Management,

Case Study: Create a SRS document for a real time scenario.

Unit – IV
Software Design: Software Design Process, Characteristics of Good Software Design, Design Principles, Modular Design, Software Architecture, Design Methodologies,

Implementation: Coding Principles, Coding Process, Code Verification, Code Documentation.

Case Study: Construct the HLD and LLD using SRS created.

Unit – V
Software Testing: Testing Fundamentals, Test Planning, Black-Box Testing, White-Box Testing, Levels of Testing, Usability Testing, Regression Testing, Debugging Approaches.

Software Quality and Reliability: Software Quality factors, Verification & Validation, Software Quality Assurance, The Capability Maturity Model, Software Reliability.

Case Study: Write the test cases for the real time scenario considered.

Text Books:
1. Software Engineering – Concepts and Practices: Ugrasen Suman, Cengage Learning, 2013.
2. Fundamentals of Software Engineering, Rajib Mall, Third Edition, Prentice Hall India.

Reference Books:
1. Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press
3. An integrated approach to Software Engineering, Pankaj Jalote, Springer Narosa.
4. Software Engineering: A practitioner's approach, Roger S. Pressman, Seventh Edition, McGraw Hill

Web Links:
1. http://nptel.ac.in/courses/106101061/
2. https://www.coursera.org/learn/software-processes-and-agile-practices
3. http://www.rspa.com/spi/process-generic.html
4. http://www.geeksforgeeks.org/software-engineering-gq/
5. https://www.tutorialspoint.com/software_engineering

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SOFTWARE TESTING METHODOLOGIES
Professional Elective II
Common to CSE & IT

	L	T	P	C
VI Semester	**L**	**T**	**P**	**C**
Course Code:191CS6E10	3	0	0	3

Course Outcomes: At the end of the Course, Student will be able to:

CO1: Explain the fundamentals of software testing.
CO2: Summarize verification and validation activities.
CO3: Develop the test cases using different testing strategies.
CO4: Describe the concepts of Efficient Test Suite Management, Quality and Debugging.
CO5: Discuss about various Automation Testing tools.

Mapping of Course Outcomes with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	1	-	-	-	-	-	-	-
CO2	2	1		1	-	-	-	-	-	-	-	-
CO3	-	2	3	-	1	-	-	-	-	-	-	-
CO4	3	-	-	1	-	-	-	-	-	-	-	-
CO5	2	2	-	-	3	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	2	-
CO4	1	-
CO5	1	-

Unit - I

Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, definition, Model for testing, Effective Vs. Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, Software Testing Methodology. Verification and Validation: Verification & Validation Activities, Verification, Verification of Requirements, High level and low level designs, verifying code, Validation.

Unit – II

Dynamic Testing-Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing White-Box Testing: need, Logic Coverage criteria, Basis Path testing, Graph matrices, Loop testing, data flow testing, mutation testing

Unit – III

Static Testing: Inspections, Structured Walkthroughs, Technical Reviews Validation activities: Unit testing, Integration Testing, Function testing, system testing, acceptance testing. Regression testing: Progressives Vs. regressive testing, Regression test ability, Objectives of regression testing, Regression testing types, Regression testing techniques.

Unit – IV

Efficient Test Suite Management: growing nature of test suite, Minimizing the test suite and its benefits, test suite prioritization, Types of test case prioritization, prioritization techniques, measuring the effectiveness of a prioritized test suite. Software Quality Management: Software Quality metrics, SQ Amodels.

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Unit – V

Automation and Testing Tools: need for automation, categorization of testing tools,

Text Books:

1. Software Testing, Principles and Practices, NareshChauhan,Oxford
2. Software Testing- YogeshSingh,CAMBRIDGE.

Reference Books:

1. Foundations of Software testing, Aditya P Mathur, 2ed,Pearson
2. Software Testing, Principles, techniques and Tools, M G Limaye,TMH
3. Effective Methods for Software testing, Willian E Perry, 3ed,Wiley

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IMAGE PROCESSING
Professional Elective II
Common to CSE & IT

VI Semester
Course Code:191CS6E07

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, Student will be able to:

CO1: Discuss the fundamental concepts of a digital image processing system.
CO2: Demonstrate the fundamentals of color image models.
CO3: Analyze images in spatial and frequency domain using various transforms.
CO4: Evaluate the techniques for image restoration.
CO5: Interpret an image using different segmentation techniques.
CO6: Make use of different types of compression techniques in image data compression.

Mapping of Course Outcomes with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	-	-	-	-	-	-	-	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-
CO3	1	2	2	3	-	-	-	-	-	-	-	-
CO4	2	2	3	1	-	-	-	-	-	-	-	-
CO5	2	3	1	1	-	-	-	-	-	-	-	-
CO6	2	3	2	2	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

	PSO1	PSO2
CO1	2	-
CO2	2	-
CO3	3	-
CO4	2	-
CO5	2	-
CO6	2	-

Unit - I
Introduction: Fundamentals Steps in Digital Image Processing, Components of an image processing system, Elements of Visual Perception ,Image Sensing and Acquisition ,Image Sampling and Quantization ,Relationships between pixels Color Image processing: Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

Unit – II
Image Enhancement: Spatial Domain: Gray level transformations , Histogram processing , Basics of Spatial Filtering, Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform, Smoothing and Sharpening frequency domain filters ,Ideal, Butterworth and Gaussian high pass filters, Homomorphic filtering.

Unit – III
Image Restoration: Image Restoration ,degradation model, Noise models, Mean Filters ,Order Statistic filters, Adaptive filters , Band reject Filters, Band pass Filters, Notch Filters ,Optimum Notch Filtering ,Inverse Filtering ,Wiener filterin

Unit – IV
Image Restoration: Image Restoration ,degradation model, Noise models, Mean Filters ,Order Statistic filters, Adaptive filters , Band reject Filters, Band pass Filters, Notch Filters ,Optimum Notch Filtering ,Inverse Filtering ,Wiener filterin

Unit – V

Image Compression and Recognition: Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors, Topological feature, Texture, Patterns and Pattern classes ,Recognition based on matching.

Text Books:

1. Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods, Third Edition, Pearson.
2. Fundamentals of Digital Image Processing, Anil K. Jain, Pearson.

Reference Books:

1. Digital Image Processing, Kenneth R. Castleman,Pearson
2. . Multidimensional Digital Signal Processing, D,E. Dudgeon and RM. Mersereau, Prentice Hall Professional Technical Reference.
3. Digital Image Processing,William K. Pratt, John Wiley, New York

Web Links:

1. http://nptel.ac.in/courses/117105079/
2. https://www.robotix.in/tutorial/imageprocessing/basicIp/
3. http://freevideolectures.com/Course/2316/Digital-Image-Processing-IIT-Kharagpur
4. https://www.cs.nmt.edu/~ip/lectures.html
5. http://nptel.ac.in/courses/117105135/

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Department of Information Technology

1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Advanced Data Structures	Advanced Data Structures
Course Code	191CS3T03	201CS3T01
Syllabus	**UNIT-I:** Dictionaries and Hashing: Sets, Dictionaries, Hash Tables, Open Hashing, Closed Hashing (Rehashing Methods), Different Hash Functions(Division Method, Multiplication Method, Mid-Square Method, Folding Method), Secure Hash Functions, Collision Resolution Techniques - Open Addressing and Closed Addressing, Dynamic Hashing.	**UNIT-I:** External Sorting: Introduction, K-way Merge Sort, Buffer Handling for parallel Operation, Run Generation, Optimal Merging of Runs, Huffman Tree. Hashing: Introduction to Static Hashing, Hash Tables, Hash Functions, Different Hash Functions, Collision Resolution Techniques, Dynamic Hashing
	UNIT-II: Introduction to Non linear Data Structures: Trees: Introduction, Types of Trees, Creating a Binary tree, Traversing a Binary Tree, Applications of Binary Tree. Priority Queues: Introduction, Binary Heaps, Basic Heap Operations, Applications of Priority Queues.	**UNIT-II:** Priority Queues (Heaps): Introduction, Binary Heaps-Model and Simple Implementation, Basic Heap Operations, Other Heap Operations, Applications of Priority Queues, Binomial Heaps (or Queues), Binomial Heap Structure and Implementation, Binomial Queue Operations.
	UNIT-III: Efficient Binary Search Trees: Binary Search Trees, Operations on Binary Search Trees, Self- balancing Binary Search Trees, AVL Trees- Operations on AVL Trees Multi-way Search Trees: B-Trees, B+ Trees.	**UNIT-III:** Efficient Binary Search Trees: Self-balancing Binary Search Tree, AVL Trees, Rotations-LL, RR, LR and RL, Searching, Insertion, Deletion operations on AVL Trees, Red-Black Tree, Properties and Representation of Red-Black Trees, Insertion and deletion operations on Red-Black Trees, Applications of Red-Black Trees.
	UNIT-IV: Graphs: Graph Terminology, Representations of	**UNIT-IV:** Multiway Search Trees: M-Way Search Trees Definition and

	Graphs, Graph Traversal Algorithms, Minimum Cost Spanning Tree-Kruskal's and Prim's algorithms, Shortest Path Algorithm Dijkstr's Algorithm, Applications of Graphs.	Properties, B-Tree Definition and Properties, Searching, Insertion and Deletion operations on B-Trees, B+ Tree, Insertion and Deletion operations on B+ Trees. Digital Search Structures: Introduction to Digital Search Tree, Operations on Digital Search Trees-Insertion, Searching, and Deletion.
	UNIT-V: Pattern matching algorithms: The Boyer –Moore algorithm, The Knuth-Morris- Pratt algorithm Tries: Definition, Digital Search Tree-Operations on Digital Search Tree, Binary trie and Patricia.	**UNIT-V:** Digital Search Structures: Binary Tries, Compressed Binary Trie, Patricia, Searching Patricia, inserting into Patricia, delete a node from Patricia, Multiway Tries- Definition, Searching a Trie, Compressed Tries, Compressed Tries with Digit Numbers-Searching, Insertion, Deletion. String Processing: String Operations, Brute-Force Pattern Matching, The BoyerMoore Algorithm, The Knuth-Morris-Pratt Algorithm, The Longest Common Subsequence Problem (LCS).

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Operating Systems	Operating Systems
Course Code	191CS5T11	201CS3T03
Syllabus	**UNIT-I:** Introduction to Operating System Concepts: What Operating System do, Operating System Structure, Operating System Operations, Process Management, Memory management, Storage Management, Protection and Security, Computing Environments, Open-Source Operating systems, Operating systems services, System call, Types of System call.	**UNIT-I:** Operating Systems Overview: Operating system functions, Operating system structure, Operating systems operations, Computing environments, Open-Source Operating Systems. System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, System Boot.
	UNIT-II: Process Management: Process Concept: The process, Process State, Process control block, Threads, Process Scheduling: Scheduling Queues, Schedulers, Context switch, Operations on Processes, Inter process Communication. Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms. Multithread Programming: Overview, Benefits, Multithreading Models.	**UNIT-II:** Process Concept: Process scheduling, Operations on processes, Inter-process communication. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues.
	UNIT-III: Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors. Deadlocks: System Model, Deadlock Characterization, Methods for handling Deadlock, Deadlock Prevention, Deadlock Avoidance,	**UNIT-III:** Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Classical IPC Problems - Dining philosophers problem, Readers and writers problem. Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm,

	Deadlock Detection, Recovery from Deadlock.	Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention.
	UNIT-IV: Memory Management: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table. Virtual Memory Management: Background, Demand Paging, Page Replacement, Thrashing.	**UNIT-IV:** Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation. File Systems: Files, Directories, File system implementation, management and optimization.
	UNIT-V: File System Interface: File concept, Access Methods, Directory and Disk structure, File system mounting, File sharing, protection. Implementing File-Systems: File system structure, File System implementation, Directory Implementation, allocation methods, free-space management. Mass-storage structure: Overview of Mass-storage structure, Disk scheduling.	**UNIT-V:** Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation. System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats. Case Studies: Linux, Microsoft Windows.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Software Engineering	Software Engineering
Course Code	191CS3T01	201CS3T04
Syllabus	**UNIT-I:** Introduction to Software Engineering: Software, Software Crisis, Software Engineering Definition, Evolution of Software Engineering Methodologies, Software Engineering Challenges Software Process: Software Process, Process Classification, Phased Development Life Cycle, Software Development Process Models. Case Study: Survey on different process models including. i. Advantages and Disadvantages of the models. ii. Applicability of the model. iii. Projects developed using the various models.	**UNIT-I:** Introduction to Software Engineering: The Nature of Software, The Unique Nature of Web Apps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths. Software Process: Software Process, Process Classification, Phased Development Life Cycle, Software Development Process Models – Waterfall Model, Iterative Waterfall Model, Prototype Model, Incremental Model, Spiral Model, Agile Process Model and RUP process Model. Case Study: Survey on different process models including. i. Advantages and Disadvantages of the models. ii. Applicability of the model. iii. Projects developed using various models.
	UNIT-II: Software Project Management: Project Management Essentials, What is Project Management, Software Configuration Management, Risk management. Project Planning and Estimation: Project Planning Activities, Software Metrics and Measurements, Project Size Estimation, Effort Estimation Techniques. Case Study: Estimate the effort of the software development using Functional Points for the real time problem.	**UNIT-II:** Software Project Management: Project Management Essentials, What is Project Management, Software Configuration Management, Risk management. Project Planning and Estimation: Project Planning Activities, Software Metrics and Measurements, Project Size Estimation, Effort Estimation Techniques. Case Study: Estimate the effort of the software development using Functional Points and COCOMO Model for any one of the real time problem.

	UNIT-III: Software Design: Software Design Process, Characteristics of Good Software Design, Design Principles, Modular Design, Software Architecture, Design Methodologies, Implementation: Coding Principles, Coding Process, Code Verification, Code Documentation. Case Study: Construct the HLD and LLD using SRS created	**UNIT-III:** Requirements Engineering: Software Requirements, Requirements Engineering Process, Requirements Elicitation and Analysis, Requirements Specification, Requirements Validation, Requirements Management. Case Study: Create a SRS document for any one of the following Software Projects. 1) Course Registration System 2) Students Marks Analyzing System 3) Online Ticket Reservation System 4) Stock Maintenance
	UNIT-IV: Requirements Engineering: Software Requirements, Requirements Engineering Process, Requirements Elicitation and Analysis, Requirements Specification, Requirements Validation, Requirements Management, Case Study: Create a SRS document for a real time scenario.	**UNIT-IV:** Software Design: Software Design Process, Characteristics of Good Software Design, Design Principles, Modular Design, Software Architecture, Design Methodologies, Implementation: Coding Principles, Coding Process, CodeVerification, Code Documentation. Case Study: Construct the DFD and CFD for any one of the following Software Projects. 1) Airline Reservation System 2) Students Marks Analyzing System 3) ATM System 4) Library Management System
	UNIT-V: Software Testing: Testing Fundamentals, Test Planning, Black-Box Testing, White- Box Testing, Levels of Testing, Usability Testing, Regression Testing, Debugging Approaches. Software Quality and Reliability: Software Quality factors, Verification & Validation, Software Quality Assurance, The Capability Maturity Model, Software Reliability. Case Study: Write the test cases for the real time scenario considered using White Box & Black Box Testing Techniques.	**UNIT**-V: Software Testing: Testing Fundamentals, Test Planning, Black-Box Testing, WhiteBox Testing, Levels of Testing, Usability Testing, Regression Testing, Debugging Approaches. Software Quality and Reliability: Software Quality factors, Verification & Validation, Software Quality Assurance, The Capability Maturity Model, Software Reliability. Case Study: Design the test cases for any one of the following real time scenarios using White Box & Black Box Testing Techniques. 1) E-Commerce application (Flipkart, Amazon) 2) Mobile Application

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Web Technologies	Web Technologies
Course Code	171CS6T16	191CS6T14
Syllabus	**UNIT-I:** HTML: Introducing HTML Document Structure, Working with Links, Images, Tables and Frames. Introduction to Forms and HTML Controls, Cascading Style Sheets. The Basics of JavaScript: Primitives, Operations, and Expressions, Screen Output and Keyboard Input, Control Statements, Arrays, Functions, Pattern Matching using Regular Expressions, Events and Event Handling.	**UNIT-I:** HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, HTML styles, Elements, Attributes, Heading, Layouts, HTML Media, Iframes, Images, Links, Lists, Tables, Forms, GET and POST method, HTML 5, Dynamic HTML. CSS: Cascading style sheets, Levels of Style Sheets, Style Specification Formats, Selector Forms, Box Model, Conflict Resolution, CSS3.
	UNIT-II: XML: Document type Definitions, XML Schemas, XSLT Style Sheets, Document Object Model, DOM and SAX Approaches	**UNIT-II:** Javascript - Introduction, Primitives, Variables – var, let, const, Operations and Expressions, Control Statements, Functions, Objects (Predefined - String, Number, Array, Date, Math, Random, RegExp, User Defined – Definition, Properties, Methods, Display, Accessors, Constructors), Events, Pattern Matching using Regular Expressions, Working with XML: Document type Definition (DTD), XML schemas, XSLT, XML and CSS, Document object model, Parsers - DOM and SAX.
	UNIT-III: PHP Programming: Introducing PHP: Creating PHP script, Running PHP Script, Working with variables and constants: Using variables, Using constants, Data types, Operators, Controlling program flow: Conditional Statements, Looping	**UNIT-III:** Node.js- Introduction, Advantages, Process Model, Modules, HTTP Module, File system, URL module, NPM, Events, Upload Files, Email. Angular JS – Introduction, Expressions, Modules, Directives, Model, Data Binding, Controllers,

	Statements, Working with Arrays, functions, Files, Directories, Working with forms and Databases: Tag and Form Elements, using PHP and MySQL. AJAX: A New Approach, Integrating PHP and AJAX.	Scopes, Filters, Services, HTTP, Tables, Select, Events, Forms, Validation, API, W3.CSS, Includes, Routing, SQL, DOM, Application.
	UNIT-IV: PERL: A Brief History of Perl, Perl Variables, Arithmetic and String Operators, Conditional Statements, Perl I/O, Perl Iterations, functions, The Perl CGI Module, Pattern Matching in Perl, Simple Page Search.	**UNIT-IV:** React JS – Introduction, Displaying "Welcome React", Introducing JSX, Rendering Elements, Components and Props, State and Lifecycle, Handling Events, Conditional Rendering, Lists and Keys, Forms, Lifting State Up, Composition vs Inheritance, Thinking in React.
	UNIT-V: Introduction to Ruby: Scalar Types and Their Operations, Simple Input and Output, Control Statements, Fundamentals of Arrays, Hashes, Methods, Classes, Blocks and Iterators, Pattern Matching. .	**UNIT-V:** PHP Programming - Introduction, Creating and Running PHP Script. Variables, Constants, DataTypes, Operators. Controlling Program Flow - Conditional and Loop statements, Arrays, Functions, Client-Server Scripting – XAMPP/LAMP Introduction, Running PHP Script in XAMPP, Super Globals, Working with Form Data, Database Connectivity – MySQL Introduction using XAMPP in Command Mode and GUI, Working with MySQL Queries, Integrating PHP and MySQL to work with Form Data. No SQL Database - MongoDB Introduction, Create and Drop Database, Create and Drop Collection, Data Types, Insert, Query, Update, Delete, Integrating PHP with MongoDB.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Software Testing Methodologies	Software Testing Methodologies
Course Code	171CS5E04	191CS6E10 .
Syllabus	**UNIT-I:** Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, Definition, Model for testing, Effective Vs Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, relate STLC to SDLC, Software Testing Methodology	**UNIT-I:** Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, definition, Model for testing, Effective Vs. Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, Software Testing Methodology. Verification and Validation: Verification & Validation Activities, Verification, Verification of Requirements, High level and low level designs, verifying code, Validation.
	UNIT-II: Verification and Validation: Verification & Validation Activities, Verification, Verification of Requirements, High level and low level designs, How to verify code, Validation. Dynamic Testing I: Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing.	**UNIT-II:** Dynamic Testing-Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing White-Box Testing: need, Logic Coverage criteria, Basis Path testing, Graph matrices, Loop testing, data flow testing, mutation testing.
	UNIT-III: Dynamic Testing II: White-Box Testing: need, Logic coverage criteria, Basis path testing, Graph matrices, Loop testing, data flow testing, mutation testing. Static Testing: Inspections, Structured Walkthroughs, Technical reviews.	**UNIT-III:** Static Testing: Inspections, Structured Walkthroughs, Technical Reviews Validation activities: Unit testing, Integration Testing, Function testing, system testing, acceptance testing. Regression testing: Progressives Vs. regressive testing, Regression test

		ability, Objectives of regression testing, Regression testing types, Regression testing techniques.
	UNIT-IV: Validation activities: Unit testing, Integration Testing, Function testing, system testing, acceptance testing. Regression testing: Progressives Vs regressive testing, Regression testability, Objectives of regression testing, When regression testing done?, Regression testing types, Regression testing techniques.	**UNIT-IV:** Efficient Test Suite Management: growing nature of test suite, Minimizing the test suite and its benefits, test suite prioritization, Types of test case prioritization, prioritization techniques, measuring the effectiveness of a prioritized test suite. Software Quality Management: Software Quality metrics, SQ Amodels. Debugging: process, techniques, correcting bugs.
	UNIT-V: Software Testing Tools: Introduction to Testing, need for Automated Testing, Taxonomy of Testing tools, Regression and performance Testing tools, Testing management tools, Source code testing tools, How to select a testing tool. Introduction to list of tools like Win runner, Load Runner, Jmeter, About Win Runner, Using Win runner, Mapping the GUI, Recording Test, working with Test, Enhancing Test, Checkpoints, Test Script Language, putting it all together, Running and Debugging Tests, Analyzing Results, Batch Tests, Rapid Test Script Wizard.	**UNIT**-V: Automation and Testing Tools: need for automation, categorization of testing tools, selection of testing tools, Cost incurred, Guidelines for automated testing, overview of some commercial testing tools such as Win Runner, Load Runner, Jmeter and JUnit. Test Automation using Selenium tool.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Image Processing	Image Processing
Course Code	171CS7E15	191CS6E07
Syllabus	**UNIT-I:** Introduction: Digital Image Processing, Examples of fields that use digital image processing, fundamental steps in digital image processing, components of image processing system. Digital Image Fundamentals: A simple image formation model, image sampling and quantization, basic relationships between pixels	**UNIT-I:** Introduction: Fundamentals Steps in Digital Image Processing, Components of an image processing system, Elements of Visual Perception ,Image Sensing and Acquisition ,Image Sampling and Quantization ,Relationships between pixels Color Image processing: Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.
	UNIT-II: Digital Image Properties: Metric and topological properties of Digital Images, Histogram, entropy, Visual Perception, Image Quality, Color perceived by humans, Color Spaces, Palette Images, color Constancy Color Images: Pixel brightness transformations, Local Preprocessing, image smoothing, Edge detectors, Robert Operators, Laplace, Prewitt, Sobel, Fri-chen, Canny Edge detection, Smoothing Spatial Filters, Sharpening Spatial Filters	**UNIT-II:** Image Enhancement: Spatial Domain: Gray level transformations , Histogram processing , Basics of Spatial Filtering, Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform, Smoothing and Sharpening frequency domain filters ,Ideal, Butterworth and Gaussian high pass filters, Homomorphic filtering. UNIT-III: Image Restoration: Image Restoration ,degradation model, Noise models, Mean Filters ,Order Statistic filters, Adaptive filters , Band reject Filters, Band pass Filters, Notch Filters ,Optimum Notch Filtering ,Inverse Filtering ,Wiener filtering.
	UNIT-III: Mathematical Morphology: Basic Mathematical Concepts, Binary dilation and Erosion, Opening and closing, Gray Scale	**UNIT-III:** Image Restoration: Image Restoration ,degradation model, Noise models, Mean Filters ,Order Statistic filters, Adaptive filters , Band reject

	dilation and erosion, Skeleton, Thinning , Thickening Ultimate erosion, Geodesic transformations, Morphology and reconstruction, Morphological Segmentation	Filters, Band pass Filters, Notch Filters ,Optimum Notch Filtering ,Inverse Filtering ,Wiener filtering.
	UNIT-IV: Segmentation: Threshold detection methods, Optimal Thresholding, Edge based Segmentation-Edge image thresholding, Edge relaxation, Border tracing, Hough Transforms, Region based segmentation: Region Merging Region Splitting, Splitting and Merging, Watershed Segmentation.	**UNIT-IV:** Image Segmentation: Edge detection, Edge linking via Hough transform, Thresholding ,Region based segmentation: Region growing, Region splitting and merging, Morphological processing: Erosion and dilation, Segmentation by morphological watersheds :basic concepts , Dam construction ,Watershed segmentation algorithm
	UNIT-V: Image Data Compression: Image data Properties, Discrete Image Transformations in data compression, Discrete Cosine and Wavelet Transforms, Types of DWT and merits; Predicative Compression methods, Hierarchical and Progressive Compression methods, Comparison of Compression methods, JPEG- MPEG Image Compression methods.	**UNIT-**V: Image Compression and Recognition: Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors, Topological feature, Texture, Patterns and Pattern classes ,Recognition based on matching.

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Program Name : B.Tech. in Petroleum Technology

Syllabus Revision for the Academic Year 2021-2022				
S.No	**Semester**	**Course Code**	**Course Name**	**% of content revised for the existing year**
1	I	201HS1T01	Communicative English	0
2	I	201BS1T01	Differential equations and Linear algebra	0
3	I	201BS1T02	Engineering Physics	0
4	I	201ES1T03	Essential Electrical and Electronics Engineering	0
5	I	201ES1T05	Engineering Graphics	0
6	I	201HS1L01	Communicative English Lab	0
7	I	201BS1L01	Engineering Physics Lab	0
8	I	201ES1L03	Essential Electrical and Electronics Engineering Lab	0
9	I	201MC1T01	Environmental Science	0
10	II	201BS2T05	Partial Differential Equations and Vector Calculus	0
11	II	201BS2T08	Chemistry of Materials	0
12	II	201ES2T06	Engineering Mechanics	0
13	II	201ES2T08	Programming for Problem Solving Using C	0
14	II	201ES2L07	Engineering Workshop	0
15	II	201ES2L12	Computer Aided Drafting Lab	0
16	II	201HS2L02	Professional Communications Skills Lab	0
17	II	201BS2L05	Engineering Chemistry Lab	0
18	II	201ES2L10	Programming for Problem Solving Using C Lab	0
19	II	201MC2T02	Constitution of India	0
20	III	201BS3T14	Numerical Methods and integral transforms	0
21	III	201PT3T01	Principles of Geology for Petroleum Engineers	0
22	III	201PT3T02	Material Balance and Energy	0
23	III	201PT3T03	Petroleum Exploration	0
24	III	201PT3T04	Fluid Mechanics for Petroleum Engineers	0
25	III	201PT3L01	Principles of Geology for Petroleum Engineers Lab	0
26	III	201PT3L02	Fluid Mechanics for Petroleum Engineers Lab	0
27	III	201PT3L03	Mathematical Methods Lab	0
28	III	201SC3L10	Skill oriented course -Industry Exploration Project	100
29	IV	201ES4T20	Mechanical and Materials Science and Engineering	0
30	IV	201BS4T17	Complex Variables and Statistical Methods	0
31	IV	201PT4T05	Petroleum Geology	0
32	IV	201PT4T06	Heat Transfer Operations	0
33	IV	201HS4T06	Management and Organizational Behavior	0
34	IV	201ES4L16	Mechanical and Materials Science and Engineering Lab	0
35	IV	201PT4L04	Heat Transfer Operations Lab	0
36	IV	201PT4L05	Petroleum Geology Lab	0
37	IV	201SC4L21	Python Programming	0
38	V	191PT5T08	Instrumentation and Process Control	0
39	V	191PT5T09	Well Logging and Mud Logging	38
40	V	191PT5T10	Drilling Technology	0
41	V	191PT5T11	Thermodynamics for Petroleum Engineers	0
42	V	191PT5E03	Well Engineering and Design	0
43	V	191PT5E02	Pipeline Engineering	0
44	V	191PT5E01	Natural Gas Engineering and Processing	100
45	V	191CE5O01	Basic Concrete Technology	100
46	V	191EE5O01	Electrical Safety	100

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
47	V	191EE5O02	Electrical Materials	100
48	V	191EE5O03	Basic Electrical Measurements	100
49	V	191ME5O01	Renewable Energy Sources	100
50	V	191ME5O02	Fundamentals of Mechanical Engineering	100
51	V	191ME5O03	Supply Chain Management	100
52	V	191ME5O04	3D Printing	100
53	V	191ME5O05	Entrepreneurship Development and Incubation	100
54	V	191EC5O01	Signals & Systems	100
55	V	191EC5O02	Digital Electronics and Logic Design	100
56	V	191EC5O03	Semi conductor devices	100
57	V	191CS5O01	Data Structures	100
58	V	191CS5O02	Object Oriented Programming through C++	100
59	V	191CS5O03	Java Programming	100
60	V	191CS5O04	R Programming	100
61	V	191IT5O01	Data Base Management Systems	100
62	V	191IT5O02	Computer Graphics	100
63	V	191MI5O01	Overview of Mining	100
64	V	191PT5O01	Process Intensification in Petroleum Industry	0
65	V	191PT5O02	Fundamentals of Petroleum Industry	0
66	V	191AG5O01	Basic Crop Production Practices	100
67	V	191PT5L04	Drilling Fluids Lab	0
68	V	191PT5L05	Instrumentation, Process Dynamics and Control Lab	0
69	V	191ES5T16	Employability Skills – III	0
70	V	191PR5P01	Socially Relevant Project	100
71	VI	191PT6T12	Petroleum Refinery and Petrochemical Engineering	0
72	VI	191PT6T13	Petroleum Production Engineering	0
73	VI	191PT6T14	Petroleum Reservoir Engineering-I	0
74	VI	191PT6E06	Well Completions, Testing and Services	0
75	VI	191PT6E05	Operational and Maintenance of Pipelines	100
76	VI	191PT6E04	Fundamentals of Liquefied Natural gas	20
77	VI	191PT6E09	Unconventional Hydrocarbon Resources	100
78	VI	191PT6E08	Storage and Transportation of Crude oil and Natural gas	0
79	VI	191PT6E07	Advanced Separation Techniques	100
80	VI	191CE6O02	Disaster Management	0
81	VI	191EE6O04	Energy Audit and Conservation Management	100
82	VI	191EE6O05	Non Conventional Energy resources	100
83	VI	191EE6O06	Instrumentation	100
84	VI	191ME6O06	Solar Energy Utilisation	100
85	VI	191ME6O07	Basic Thermodynamics and Heat Transfer	100
86	VI	191ME6O08	Introduction to Hydraulics and Pneumatics	100
87	VI	191ME6O09	3D Printing	100
88	VI	191ME6O06	Robotics	100
89	VI	191ME6O09	Management Science	100
90	VI	191ME6O12	Entrepreneurship Development and Incubation	100
91	VI	191ME6O07	Biomedical Instrumentation	100
92	VI	191ME6O08	ECAD Tools	100
93	VI	191CS6O05	Python Programming	100
94	VI	191CS6O06	Operating Systems	100
95	VI	191CS6O07	Web Technologies	100
96	VI	191CS6O08	Cyber Security	100
97	VI	191CS6O09	AR / VR	100
98	VI	191IT6O03	Computer Organization	100
99	VI	191IT6O04	AI Tools & Techniques	100
100	VI	191IT6O05	Robotic Process Automation	100

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
101	VI	191MI6O02	Industrial Safety Practices	100
102	VI	191MI6O03	Electrical Equipment's in Mines	100
103	VI	191PT6O03	Unconventional Hydrocarbon Resources	100
104	VI	191PT6O04	Asset Management	100
105	VI	191PT6L06	Petroleum Reservoir Engineering Lab	0
106	VI	191PT6L07	Petroleum Analysis Lab	0
107	VI	191ES6T17	Employability Skills - IV	0
108	VII	171PT7T15	Integrated Asset Management and Petroleum Economics	0
109	VII	171PT7T16	Petroleum Reservoir Engineering - II	0
110	VII	171PT7T17	IOR and EOR Techniques	0
111	VII	171PT7T18	Oil and Gas Processing Plant Design	0
112	VII	171PT7E10	Coal Bed Methane	0
113	VII	171PT7E11	Offshore Engineering	0
114	VII	171PT7E12	Petroleum Corrosion Technology	0
115	VII	171PT7E13	Shale Gas Reservoir Engineering	0
116	VII	171PT7E14	Subsea Engineering	0
117	VII	171PT7E15	Reservoir Modeling and Simulation	0
118	VII	171PT7L07	Petroleum Equipment Design and Simulation Lab	0
119	VII	171PT7L08	Petroleum Reservoir Engineering Lab	0
120	VII	171HS7A04	Managerial Economics and Financial Analysis	0
121	VII	171PT7P01	Industry Oriented (Internship) Minor Project	0
122	VIII	171PT8E16	HSE and FE in Petroleum Industry	0
123	VIII	171PT8E17	Reliability and Risk Management in Petroleum Operations	0
124	VIII	171PT8E18	Deep Sea Production Systems	0
125	VIII	171PT8O01	Green Technologies	0
126	VIII	171PT8O02	Non-Conventional Sources of Energy	0
127	VIII	171PT8O03	Alternative Energy Sources for Automobiles	0
128	VIII	171PT8O04	Waste Water Treatment	0
129	VIII	171PT8O05	Computational Fluid Dynamics	0
130	VIII	171PT8O06	Process Intensification in Petroleum Industry	0
131	VIII	171EC8O02	Disaster Management	0
132	VIII	171PT8P02	Major Project	0

Total number of courses in the academic year 2021-2022	= 131
Number of courses having revision in syllabus content >/= 20% in the academic year 2021-2022	= 52
Percentage of syllabus revision carried out in the academic year 2021-2022 = (52/131)*100	= 38.93%

Program Coordinator

Head of the Department

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PROGRAM STRUCTURE

I SEMESTER

Course Code	Course Title	Course Component	Course Type	Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	Credits (C)
				Total Number of contact hours				
201HS1T01	Communicative English	HSMC	Theory	3	0	0	3	3
201BS1T01	Differential equations and Linear algebra	BSC	Theory	3	0	0	3	3
201BS1T02	Engineering Physics	BSC	Theory	3	0	0	3	3
201ES1T03	Essential Electrical and Electronics Engineering	ESC	Theory	3	0	0	3	3
201ES1T05	Engineering Graphics	ESC	Theory	1	0	4	5	3
201HS1L01	Communicative English Lab	HSMC	Lab	0	0	3	3	1.5
201BS1L01	Engineering Physics Lab	BSC	Lab	0	0	3	3	1.5
201ES1L03	Essential Electrical and Electronics Engineering Lab	ESC	Lab	0	0	3	3	1.5
201MC1T01	Environmental Science	MC	Theory	2	0	0	2	0
			TOTAL	15	0	13	28	19.5

II SEMESTER

Course Code	Course Title	Course Component	Course Type	Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	Credits (C)
				Total Number of contact hours				
201BS2T05	Partial Differential Equations and Vector Calculus	BSC	Theory	3	0	0	3	3
201BS2T08	Chemistry of Materials	BSC	Theory	3	0	0	3	3
201ES2T06	Engineering Mechanics	ESC	Theory	3	0	0	3	3
201ES2T08	Programming for Problem Solving Using C	ESC	Theory	3	0	0	3	3
201ES2L07	Engineering Workshop	ESC	Lab	0	0	3	3	1.5
201ES2L12	Computer Aided Drafting Lab	ESC	Lab	0	0	3	3	1.5
201HS2L02	Professional Communications Skills Lab	HSMC	Lab	0	0	3	3	1.5
201BS2L05	Engineering Chemistry Lab	BSC	Lab	0	0	3	3	1.5
201ES2L10	Programming for Problem Solving Using C Lab	ESC	Lab	0	0	3	3	1.5
201MC2T02	Constitution of India	MC	Theory	2	0	0	2	0
			TOTAL	14	0	15	29	19.5

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III SEMESTER								
Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS3T14	Numerical Methods and Integral Transforms	BSC	Theory	3	0	0	3	3
201PT3T01	Principles of Geology for Petroleum Engineers	PCC	Theory	3	0	0	3	3
201PT3T02	Material and Energy Balance	PCC	Theory	3	0	0	3	3
201PT3T03	Petroleum Exploration	PCC	Theory	3	0	0	3	3
201PT3T04	Fluid Mechanics for Petroleum Engineers	PCC	Theory	3	0	0	3	3
201PT3L01	Principles of Geology for Petroleum Engineers lab	PCC	Lab	0	0	3	3	1.5
201PT3L02	Fluid Mechanics for Petroleum Engineers Lab	PCC	Lab	0	0	3	3	1.5
201PT3L03	Mathematical Methods Lab	PCC	Lab	0	0	3	3	1.5
201SC3L10	Skill oriented course -I Industry Exploration Project	SC	Proj	0	0	4	4	2
201MC3T03	Biology For Engineers	MC	Theory	2	0	0	2	0
			TOTAL	17	0	13	30	21.5

IV SEMESTER								
Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201ES4T20	Mechanical and Materials Science and Engineering	ESC	Theory	3	0	0	3	3
201BS4T17	Complex Variables and Statistical Methods	BSC	Theory	3	0	0	3	3
201PT4T05	Petroleum Geology	PCC	Theory	3	0	0	3	3
201PT4T06	Heat Transfer Operations	PCC	Theory	3	0	0	3	3
201HS4T06	Management and Organizational Behavior	HSMC	Theory	3	0	0	3	3
201ES4L16	Mechanical and Materials Science and Engineering Lab	ESC	Lab	0	0	3	3	1.5
201PT4L04	Heat Transfer Operations Lab	PCC	Lab	0	0	3	3	1.5
201PT4L05	Petroleum Geology Lab	PCC	Lab	0	0	3	3	1.5
201SC4L21	Skill oriented course-II Python Programming	SC	Proj	0	0	4	4	2
201MC4T04	Essence of Indian Traditional Knowledge	MC	Theory	2	0	0	2	0
			TOTAL	17	0	13	30	21.5
Internship 2 months (Mandatory) during summer vacation								

BSC: Basic Sciences Courses; HSMC: Humanities and Social Sciences including Management Courses; ESC: Engineering Sciences Courses; PCC: Professional Core Courses; SC: Skill Oriented Course; PEC: Professional Elective Courses; OEC: Open Elective Courses; MC: Mandatory Courses; PROJ: Project.

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V SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
191PT5T08	Instrumentation and Process Control	PCC	3	0	0	3	3
191PT5T09	Well Logging and Mud Logging	PCC	3	0	0	2	2
191PT5T10	Drilling Technology	PCC	3	0	0	3	3
191PT5T11	Thermodynamics for Petroleum Engineers	PCC	3	0	0	3	3
----	Professional Elective-I	PEC	3	0	0	3	3
----	Open Elective –I	OEC	3	0	0	3	3
191PT5L04	Drilling Fluids Lab	PCC	0	0	2	2	1
191PT5L05	Instrumentation, Process Dynamics and Control Lab	PCC	0	0	3	3	1.5
191ES5T16	Employability Skills – III	ESC	0	0	2	2	1
191PR5P01	Socially Relevant Project	PROJ	0	0	0	0	1
191MC5A08	Intellectual Property Rights and Patents	MC	2	0	0	2	0
		TOTAL	**18**	**0**	**7**	**24**	**21.5**

VI SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
191PT6T12	Petroleum Refinery and Petrochemical Engineering	PCC	3	0	0	3	3
191PT6T13	Petroleum Production Engineering	PCC	3	0	0	3	3
191PT6T14	Petroleum Reservoir Engineering-I	PCC	3	0	0	3	3
----	Professional Elective -II	PEC	3	0	0	3	3
----	Professional Elective -III	PEC	3	0	0	3	3
----	Open Elective –II	OEC	3	0	0	3	3
191PT6L06	Petroleum Reservoir Engineering Lab	PCC	0	0	2	2	1
191PT6L07	Petroleum Analysis Lab	PCC	0	0	3	3	1.5
191ES6T17	Employability Skills - IV	ESC	0	0	2	2	1
191MC6A09	Professional Ethics and Human Values	MC	2	0	0	2	0
		TOTAL	**18**	**0**	**7**	**25**	**21.5**

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VII SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
191PT7T15	Petroleum Reservoir Engineering – II	PCC	3	0	0	3	3
191PT7T16	Design of Surface Facilities	PCC	3	0	0	3	3
----	Professional Elective -IV	PEC	3	0	0	3	3
----	Professional Elective -V	PEC	3	0	0	3	3
----	Open Elective –III	OEC	3	0	0	3	3
191PT7L08	Petroleum Equipment Design and Simulation Lab	PCC	0	0	2	2	1
191PT7L09	Petroleum Reservoir Simulation Lab	PCC	0	0	2	2	1.5
191PR7P02	Internship	PROJ	0	0	0	0	2
191PT7P03	Project Part 1	PROJ	0	0	0	0	2
		TOTAL	15	0	4	19	21.5

VIII SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
----	Professional Elective -VI (MOOCs)	PEC	3	0	0	3	3
----	Open Elective -IV (MOOCs)	OEC	3	0	0	3	3
191PT8P04	Project Part 2	PROJ	0	0	0	-	7
		TOTAL	6	0	0	6	13

BSC: Basic Sciences Courses; HSMC: Humanities and Social Sciences including Management Courses; ESC: Engineering Sciences Courses; PCC: Professional Core Courses; PEC: Professional Elective Courses; OEC: Open Elective Courses; SSC: Self Study Course; MC: Mandatory Courses; PROJ: Project.

PROFESSIONAL ELECTIVES

Professional Elective – I (V Semester)			Professional Elective – II (VI Semester)		
S.No	Course Code	Name of the Course	S.No	Course Code	Name of the Course
1	191PT5E03	Well Engineering and Design	1	191PT6E06	Well Completions, Testing and Services
2	191PT5E02	Pipeline Engineering	2	191PT6E05	Operational and Maintenance of Pipelines
3	191PT5E01	Natural Gas Engineering and Processing	3	191PT6E04	Fundamentals of Liquefied Natural gas
Professional Elective – III (VI Semester)			**Professional Elective – IV (VII Semester)**		
S.No	Course Code	Name of the Course	S.No	Course Code	Name of the Course
1	191PT7E09	Unconventional Hydrocarbon Resources	1	191PT7E10	Enhanced Oil Recovery
2	191PT7E08	Storage and Transportation of Crude oil and Natural gas	2	191PT7E12	Petroleum Economics and Polices and Regulations
3	191PT7E07	Advanced Separation Techniques	3	191PT7E11	Petroleum Corrosion Technology

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FUNDAMENTALS OF LIQUEFIED NATURAL GAS

(Professional Elective–II)

VI Semester **L T P C**

Course Code: 191PT6E04 **3 0 0 3**

Course Outcomes:

At the end of the course, the studentwill beable to:

CO 1: Explain the LNG value chain.

CO 2: Classify the different liquefaction technologies of LNG.

CO 3: Explain the components of LNG receiving terminals.

CO 4: Summarize LNG storage and transportation facilities.

CO 5: Identify major equipment and safety aspects of LNG industry.

MappingofCourseOutcomeswithProgramOutcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	3	2	-	-	-	-	-	-	-	-	-	2
CO4	3	2	-	-	-	-	-	-	-	-	-	2
CO5	3	2	-	-	-	-	-	-	-	-	-	2

MappingofCourseOutcomeswithProgramSpecificOutcomes:

CO/PSO	PSO 1	PSO 2
CO1	-	2
CO2	-	2
CO3	-	2
CO4	-	2
CO5	-	2

UNIT– I

Introduction Overview of LNG industry: History of LNG industry – Base load LNG – Developing an LNG Project – World andIndian Scenario– Propertiesof LNG.

UNIT– II

Liquefaction Technologies: Propane precooled mixed refrigerant process – Description of Air products C3MR LNG process Liquefaction- LNG flash and storage.

Cascade process: Description of ConocoPhillips optimized cascade (copoc) process –Liquefaction– LNG flash and storage.Other Liquefaction Processes: Description of Linde MFC LNG process- Precooling and Liquefied Petroleum Gas (LPG) recovery – Liquefaction and subcooling- Trends in LNG train capacity – strategy for grassroots plant- offshore LNG production.

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UNIT– III

Supporting Functional Units in LNG Plants: Gas pretreatment: Slugcatcher– NGL stabilization column – Acid gas removal unit – Molecular sieve dehydrating unit –Mercury and sulfur removal unit–NGL recovery–Nitrogen rejection–Helium recovery.

UNIT– IV

Receiving Terminals: Receiving terminals in India – Main components and description of marine facilities – storage capacity– Process descriptions.

Integration with adjacent facilities–Gas interchangeability–Nitrogen injection–Extraction of C2+ components.

LNG Shipping Industry

LNG Shipping Industry: LNG fleet – Types of LNG ships – Moss – Membrane –prismatic; Cargo measurement and calculations.

UNIT– V

Major equipment inLNG industry– Cryogenic heatexchangers: Spiral– Woundheat exchangers – Plate &fin heat exchangers – Cold boxes; Centrifugal compressors –Axial compressors – Reciprocating compressors; LNG pumps and liquid expanders – LoadingArms and gas turbines.

Regasification of LNG: Description of Regasification,

Vaporizers: Submerged combustion vaporizers-Open rack vaporizers–Shell and tube vaporizers: direct heating with seawater, and indirect heating with seawater.
Ambient air vaporizers: Direct heating with ambient air – Indirect heating with ambientair.LNG tanks.
Safety, Security and Environmental Issues:
Safety design of LNG facilities – Security issues for the LNG industry – Environmental issues– Risk-based analysis of an LNG plant.

TextBooks:

1. LNG: Basics of Liquefied Natural Gas, Stanley Huang, HwaChiu and Doug Elliot, Ist Edition, PETEX, 207.
2. Marine Transportation of LNG (Liquefied) and related products, Richard G. Wooler, Gornell Marine Press, 1975.
3. Marine Transportation of Liquefied Natural Gas, Robert P Curt, Timothy D. Delaney, National Maritime Research Centre, 1973.

ReferenceBooks:

1. Natural Gas by Sea: The Development of a new technology, Roger Rooks, Wither by, 1993.
2. Natural Gas: Production, Processing, and Transport, AlexandreRojey, Editions OPHRYS, 1997.
3. LNG: A Nontechnical Guide, Michael D'Tusiani, Gordon Shearer PennWell Books, 2007.
4. Natural Gas Transportation, Storage and Use, Mark Fennell Amazon Digital Services, Inc., 2011.
5. Liquefied Gas Handling Principles on Ships and in Terminals, McGuire and White, 3rd Edition, Wetherby Publishers, 2000.

OPEN ELECTIVE - II (VI Semester)

S. No	Course Code	Course Name	Not Offered to Branches	Offered By Department
1	191CE6O02	Disaster Management		CE
2	191EE6O04	Energy Audit and Conservation Management	EEE	EEE
3	191EE6O05	Non-Conventional Energy Sources	EEE	EEE
4	191EE6O06	Instrumentation	EEE, ECE, Ag. E	EEE
5	191ME6O06	Solar Energy Utilisation	ME, Ag. E	ME
6	191ME6O07	Basic Thermodynamics and Heat Transfer	EEE, ME, PT, Ag.E, Min.E	ME
7	191ME6O08	Introduction to Hydraulics and Pneumatics	CE, ME, PT	ME
8	191ME6O09	3D Printing	ME	ME
9	191ME6O10	Robotics	ME	ME
10	191ME6O11	Management Science	CE, CSE, IT, PT, Min. E	ME
11	191ME6O12	Entrepreneurship Development and Incubation		ME
12	191EC6O04	Biomedical Instrumentation		ECE
13	191EC6O05	ECAD Tools	ECE	ECE
14	191CS6O05	Python Programming	EEE, CSE, IT	CSE
15	191CS6O06	Operating Systems	CSE, IT	CSE
16	191CS6O07	Web Technologies	CSE, IT	CSE
17	191CS6O08	Cyber Security	CSE, IT	CSE
18	191CS6O09	AR / VR		CSE
19	191IT6O03	Computer Organization	CSE, IT	IT
20	191IT6O04	AI Tools & Techniques	CSE, IT	IT
21	191IT6O05	Robotic Process Automation		IT
22	191MI6O02	Industrial Safety Practices	Ag.E	Min.E
23	191MI6O03	Electrical Equipment in Mines		Min.E
24	191PT6O03	Unconventional Hydrocarbon Resources	PT	PT
25	191PT6O04	Asset Management		PT
26	191AG6O02	Weather forecast in Agriculture		Ag.E
27	191AG6O03	Bio-energy systems design and applications		Ag.E

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OPEN ELECTIVE - I (V Semester)

S. No	Course Code	Course Name	Not Offered to Branches	Offered By Department
1	191CE5O01	Basic Concrete Technology	CE, EEE	CE
2	191EE5O01	Electrical Safety	EEE	EEE
3	191EE5O02	Electrical Materials	EEE	EEE
4	191EE5O03	Basic Electrical Measurements	EEE, ECE	EEE
5	191ME5O01	Renewable Energy Sources	CE, EEE, ME, Ag. E	ME
6	191ME5O02	Fundamentals of Mechanical Engineering	ME	ME
7	191ME5O03	Supply Chain Management	ME	ME
8	191ME5O04	3D Printing	ME	ME
9	191ME5O05	Entrepreneurship Development and Incubation		ME
10	191EC5O01	Signals & Systems	EEE, ECE	ECE
11	191EC5O02	Digital Electronics and Logic Design	EEE, ECE, CSE, IT	ECE
12	191EC5O03	Semi conductor devices	EEE, ECE	ECE
13	191CS5O01	Data Structures	EEE, ECE, CSE, IT	CSE
14	191CS5O02	Object Oriented Programming through C++	CSE, IT	CSE
15	191CS5O03	Java Programming	CSE, IT	CSE
16	191CS5O04	R Programming		CSE
17	191IT5O01	Database Management Systems	CSE, IT	IT
18	191IT5O02	Computer Graphics	CSE, IT	IT
19	191MI5O01	Overview of Mining	Min.E	Min.E
20	191PT5O01	Process Intensification in Petroleum Industry	PT	PT
21	191PT5O02	Fundamentals of Petroleum Industry	PT	PT
22	191AG5O01	Basic Crop Production Practices	Ag.E	Ag.E

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VII SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
171PT7T15	Integrated Asset Management and Petroleum Economics	PC	3	1	0	4	3
171PT7T16	Petroleum Reservoir Engineering - II	PC	3	1	0	4	3
171PT7T17	IOR and EOR Techniques	PC	3	1	0	4	3
171PT7T18	Oil and Gas Processing Plant Design	PC	3	1	0	4	3
---	**Professional Elective - IV**	PE	3	1	0	4	3
---	**Professional Elective - V**	PE	3	1	0	4	3
171PT7L07	Petroleum Equipment Design and Simulation Lab	PC	0	0	3	3	2
171PT7L08	Petroleum Reservoir Engineering Lab	PC	0	0	3	3	2
171HS7A04	Managerial Economics and Financial Analysis	HSS	2	0	0	2	0
171PT7P01	Industry Oriented (Internship) Minor Project	PR	0	0	0	0	1
		TOTAL	20	6	6	32	23

VIII SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
---	**Professional Elective - VI**	PE	3	1	0	4	3
---	**Open Elective**	OE	3	1	0	4	3
171PT8P02	**Major Project**	PR	0	0	0	0	14
		TOTAL	6	2	0	8	20

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Professional Elective – I (V Semester)

S.No	Course Code	Name of the Course
	171PT5E01	Well Engineering and Design
2	171PT5E02	Fundamentals of Liquefied Natural Gas
3	171PT5E03	Pipeline Engineering

Professional Elective – II (VI Semester)

S.No	Course Code	Name of the Course
1	171PT6E04	Petroleum Refining and Petrochemical Engineering
2	171PT6E05	Storage and Transportation of Crude Oil and Natural Gas.
3	171PT6E06	Reservoir Stimulation

Professional Elective – III (VI Semester)

S.No	Course Code	Name of the Course
1	171PT6E07	Natural Gas Hydrates
2	171PT6E08	Natural Gas Engineering
3	171PT6E09	Horizontal Well Technology

Professional Elective – IV (VII Semester)

S.No	Course Code	Name of the Course
1	171PT7E10	Coal Bed Methane
2	171PT7E11	Offshore Engineering
3	171PT7E12	Petroleum Corrosion Technology

Professional Elective – V (VII Semester)

S.No	Course Code	Name of the Course
1	171PT7E13	Shale Gas Reservoir Engineering
2	171PT7E14	Subsea Engineering
3	171PT7E15	Reservoir Modeling and Simulation

Professional Elective – VI (VIII Semester)

S.No	Course Code	Name of the Course
1	171PT8E16	HSE and FE in Petroleum Industry
2	171PT8E17	Reliability and Risk Management in Petroleum Operations
3	171PT8E18	Deep Sea Production Systems

Open Elective (VIII Semester)

S.No	CourseCode	Name of the Course
1	171PT8O01	Green Technologies
2	171PT8O02	Non-Conventional Sources of Energy
3	171PT8O03	Alternative Energy Sources for Automobiles
4	171PT8O04	Waste Water Treatment
5	171PT8O05	Computational Fluid Dynamics
6	171PT8O06	Process Intensification in Petroleum Industry
7	171EC8O02	Disaster Management

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WELL LOGGING AND MUD LOGGING

V Semester **L T P C**
Course Code: 191PT5T09 **2 0 0 2**

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1: Apply the principles of open hole logs for subsurface interpretation.
CO 2: Make use of principles of different cased hole and production logging techniques to decipher subsurface properties.
CO 3: Interpret the different log data using different quick look interpretation techniques.
CO 4: Explain the basics of mud logging in evaluate formation.
CO 5: Apply principles of mud logging techniques in drilling control.

Mapping of course outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	2
CO2	3	-	-	-	-	-	-	-	-	-	-	2
CO3	3	-	-	-	-	-	-	-	-	-	-	2
CO4	3	-	-	-	-	-	-	-	-	-	-	2
CO5	3	-	-	-	-	-	-	-	-	-	-	2

Mapping of course outcomes with Program Specific Outcomes:

CO / PSO	PSO 1	PSO 2
CO1	-	2
CO2	-	2
CO3	-	2
CO4	-	2
CO5	-	2

UNIT-I:
Mud Logging Basics: Equipment, Services and Personnel, The Mud Log, Mud Logging Operations, Drill Cuttings Analysis, Gas Extraction and Monitoring, Show Evaluation, Conventional Coring, Sidewall Coring, Sidewall coring, Core orientation, Core Handling, Core alteration and preservation, Problems in interpreting drill cuttings.

UNIT-II:
Mud Logging Applications: Beginning of an oil kick, Detection of Water kick, Use of chromatograph to detect abnormal pressures in under compacted series, Circulation out a gas kick, Drilling through an evaporitic series, Drilling through a Sandstone series with salt-cemented sand layers.

UNIT - III
Openhole Logging
Introduction: Definition and Borehole environment, Openhole Logging- Electrical Logs: SP Logging,Resistivity log, Micro resistivity log, Induction log; Radioactivity logs: Gamma ray log, Natural Spectral Gamma ray log, Density log, Litho density log, Neutron log; Sonic log and Caliper log.

UNIT-IV:

Cased Hole Logging and Production Logging:

Cased hole logging: Gamma ray spectral log-Determination of fluid saturation behind casing-Cement bond log- Casing collar log-Depth control- Perforation technique-Casing inspection logs.

Production logging: Solving production problems with the help of Fluid Density log-Temperature log and Flow meter logs.

UNIT-V:

Advances in Well Logging and Interpretation:

Advances in Well logging: Dip meter log-Cased hole resistivity logs -Nuclear magnetic resonance log & Scanner logs (Sonic scanner, MR scanner Rt scanner).Calculating the dip of the formations.

Interpretation: Quick look interpretation- Cross plots and interpretation. Neutron-Density, Sonic- Density, Sonic-Neutron cross plots-Hingle plot-Mid plot – Correlation- Hydrocarbon reserve estimate

Text Books:

1. Log Interpretation Principles/Applications, Schlumberger, 1989
2. Well Logging and Formation Evaluation, Toby Darling, Elsevier, New York, 2005.
3. Well Logging & Reservoir Evaluation, Oberto Serra, Editions Technip, 2007.
4. Formation Evaluation, Edward J. Lynch, Harper & Row, 1962.
5. Development Geology Reference Manual Edited by Diana Morton – Thomson, Arnold M Woods
6. Geological and Mud Logging in Drilling Control: Catalogue of Typical Cases, Graham Trotman Limited, 1982.

Reference Books:

1. Hydrocarbon well logging recommended practice, society of professional well log analysts.
2. Open-hole log analysis and formation evaluation, Richard M. Batemons, International Human resources Development Corporation, Bostan, 1985.
3. Well logging for Earth Scientists, Darwin V. Ellis, Julian M. Singer, Springer, 2007
4. Well Logging Handbook, Oberto Serra, Editions Technip, 2008.
5. Sample Examination Manual, R.G.Swanson, Shell Oil Company, Published byAAPG.
6. Drilling Engineering Handbook, E.H.Austin, International Human Resources Development Corporation, 1983.

Web Links:

1. https://link.springer.com/chapter/10.1007%2F978-3-319-29710-1_3petrowiki.org /Typesoflogs
2. www.pe.tamu.edu/blasingame/data/z_zCourse_Archive/P663.../GR%20Log.PDF

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6. Handbook of LNG, 2013

Web Links:

1. http://folk.ntnu.no/skoge/prost/proceedings/aiche2008/data/papers/P139095.pdf
2. https://ceonline.austin.utexas.edu/petexonline/file.php/1/ebook_demos/lng/html/ind ex. html
3. http://petrowiki.org/Liquified_natural_gas_(LNG)
4. http://www.chebeague.org/fairwinds/risks.html
5. http://www.beg.utexas.edu/energyecon/LNG_Safety_and_Security_Update_2012.p df

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Department of Petroleum Technology

Syllabus revision Index 2021-2022

S.No	Name of the course	Percentage of syllabus change
1	Fundamentals of Liquefied Natural gas	20
2	Well Logging and Mud Logging	38
3	Instrumentation and Process Control	40

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	FUNDAMENTALS OF LIQUEFIED NATURAL GAS	FUNDAMENTALS OF LIQUEFIED NATURAL GAS
Course Code	171PT5E02	191PT6E04
Syllabus	UNIT – V Major equipment in LNG industry – Cryogenic heat exchangers: Spiral – Wound heat exchangers – Plate &fin heat exchangers – Cold boxes; Centrifugal compressors – Axial compressors – Reciprocating compressors; LNG pumps and liquid expanders – Loading Arms and gas turbines. Vaporizers: Submerged combustion vaporizers- Open rack vaporizers–Shell and tubevaporizers: direct heating withseawater, andindirect heating with seawater. Ambient air vaporizers: Direct heating with ambient air – Indirect heating with ambient air. LNG tanks. Safety, Security and Environmental Issues: Safety design of LNG facilities – Security issues for the LNG industry – Environmental issues – Risk-based analysis of an LNG plant.	UNIT – V Major equipment in LNG industry – Cryogenic heat exchangers: Spiral – Wound heat exchangers – Plate &fin heat exchangers – Cold boxes; Centrifugal compressors – Axial compressors – Reciprocating compressors; LNG pumps and liquid expanders – Loading Arms and gas turbines. Regasification of LNG: Description of Regasification, Vaporizers: Submerged combustion vaporizers- Open rack vaporizers– Shell and tube vaporizers: direct heating with seawater, and indirect heating with seawater. Ambient air vaporizers: Direct heating with ambient air – Indirect heating with ambient air. LNG tanks. Safety, Security and Environmental Issues: Safety design of LNG facilities – Security issues for the LNG industry – Environmental issues – Risk-based analysis of an LNG plant.

Signature of the course coordinator

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	WELL LOGGING AND FORMATION EVALUATION	WELL LOGGING AND MUD LOGGING
Course Code	171PT5T09	191PT5T09
Syllabus	. UNIT-I Direct Methods of Formation Evaluation and Concepts of well logging: Mud logging- coring – conventional and sidewall coring - Core analysis. What is well logging? – Logging terminology-Borehole environment-Borehole temperature and pressure-Log header and depth scale-Major components of well logging unit and logging setup- Classification of well logging methods-Log presentation- Log quality control	UNIT-I: Mud Logging Basics: Equipment, Services and Personnel, The Mud Log, Mud Logging Operations, Drill' Cuttings Analysis, Gas Extraction and Monitoring, Show Evaluation, Conventional Coring, Sidewall Coring, Sidewall coring, Core orientation, Core Handling, Core alteration and preservation, Problems in interpreting drill cuttings.
	UNIT-II Open hole Logging and Electrical Log Open hole logging: SP Logging- Origin of SP, uses of SP log-Calculation of salinity of formation water- Shaliness-Factors influence SP log. Resistivity log: Single point resistance log (SPR)- Conventional resistivity logs-Response of potential and gradient logs over thin and thick conductive and resistive formations-Limitations of conventional resistivity tools. Caliper log: Principle and application of caliper tool. Micro resistivity log: Conventional and focused micro resistivity logs and their application. Induction log: Principle of induction tool and the advantages, Determination of true resistivity (Rt) of the formation-Resistivity index-Archie's equation.	UNIT-II: Mud Logging Applications: Beginning of an oil kick, Detection of Water kick, Use of chromatograph to detect abnormal pressures in under compacted series, Circulation out a gas kick, Drilling through an evaporitic series, Drilling through a Sandstone series with salt-cemented sand layers.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	PROCESS DYNAMICS AND CONTROL	INSTRUMENTATION AND PROCESS CONTROL
Course Code	171PT5T06	191PT5T08
Syllabus	Fundamentals: Elements of instruments, static and dynamic characteristics-Basic concepts of response of first-order type instruments. Industrial Thermometers-1: Mercury in glass thermometer-Bimetallic Thermometer-Pressure spring thermometer, Static accuracy and response of thermometry.	Fundamentals: Elements of instruments, Functions of instruments and Characteristics of an instruments. Industrial Thermometers: Expansion thermometers and its types, Static accuracy and response of thermometry. Thermoelectricity-Industrial Thermocouples-Thermocouple wires-Thermocouple wells and response of thermocouples; Thermal coefficient of resistance-Industrial resistance-thermometer bulbs and circuits-Radiation receiving elements-Radiation pyrometers-photoelectric and optical pyrometers.
	UNIT-II Industrial Thermometers-2: Thermoelectricity-Industrial Thermocouples-Thermocouple wires-Thermocouple wells and response of thermocouples; Thermal coefficient of resistance-Industrial resistance-thermometer bulbs and circuits-Radiation receiving elements-Radiation photoelectric and optical pyrometers.	UNIT-II Pressure and vacuum: Liquid column manometers-Measuring elements for gauge pressure and vacuum-indicating elements for pressure gauges-Static accuracy and response of pressure gauges. Composition analysis: Spectroscopic analysis by absorption, emission and mass, Gas analysis by thermal conductivity, analysis of moisture.
	UNIT-III Composition analysis: Spectroscopic analysis by absorption, emission, mass and color measurement spectrometers-Gas analysis by thermal conductivity, analysis of moisture. Pressure, vacuum and head: Liquid column manometers-Measuring elements for gauge pressure and vacuum-indicating elements for pressure gauges-Measurement of absolute pressure-Measuring pressure in corrosive liquids-Static accuracy and response of pressure gauges.	UNIT-III Flow Meters: Head flow meters-Area flow meters-Viscosity measurements. Process Instrumentatibn: Controls center-Instrumentation diagram-Process analysis-Digital instrumentation and SCADA systems
	UNIT-IV Density and specific gravity measurements- Direct measurement of liquid level-Pressure measurement in open vessels-Level measurements in pressure vessels-Measurement of interface level-Density measurement and level of dry materials.	UNIT-IV Introduction to process dynamics and control: Response of first order systems – Physical examples of first order systems. Response of first order systems in series, higher order systems: Second order and transportation lag.
	UNIT-V Flow Meters: Head flow meters-Area flow meters-Open channel meters-Viscosity meters-Quantity	UNIT-V: Control systems, controllers and final control elements, Block diagram of a Petrochemical rector

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	meters-Flow of dry materials-Viscosity measurements. Recording instruments-Indicating and signaling instruments-Transmission of instrument readings-Controls center-Instrumentation diagram-Process analysis-Digital instrumentation, SCADA systems.	control system. Closed loop transfer functions, Transient response of simple control systems. Stability Criterion, Routh Test, Frequency control model, Controller tuning and process identification, Control valves.

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Program Name : B.Tech. in Mining Engineering

Syllabus Revision for the Academic Year 2021-2022				
S.No	**Semester**	**Course Code**	**Course Name**	**% of content revised for the existing year**
1	1	201HS1T01	Communicative English	0
2	1	201BS1T01	Differential equations and Linear algebra	0
3	1	201BS1T02	Engineering Physics	0
4	1	201ES1T03	Essential Electrical and Electronics Engineering	0
5	1	201ES1T05	Engineering Graphics	0
6	1	201HS1L01	Communicative English Lab	0
7	1	201BS1L01	Engineering Physics Lab	0
8	1	201ES1L03	Essential Electrical and Electronics Engineering Lab	0
9	1	201MC1T01	Environmental Science	0
10	2	201BS2T05	Partial Differential Equations and Vector Calculus	0
11	2	201BS2T08	Chemistry of Materials	0
12	2	201ES2T06	Engineering Mechanics	0
13	2	201ES2T08	Programming for Problem Solving Using C	0
14	2	201ES2L07	Engineering Workshop	0
15	2	201ES2L12	Computer Aided Drafting Lab	0
16	2	201HS2L02	Professional Communications Skills Lab	0
17	2	201BS2L05	Engineering Chemistry Lab	0
18	2	201ES2L10	Programming for Problem Solving Using C Lab	0
19	2	201MC2T02	Constitution of India	0

20	3	201BS3T14	Numerical Methods and Integral Transforms	0
21	3	201ES3T17	Basic Mechanical Engineering	0
22	3	201MI3T01	Mining Geology	0
23	3	201MI3T02	Mine Surveying	0
24	3	201MI3T03	Development of Mineral Deposits	0
25	3	201MI3L01	Geology Lab	0
26	3	201MI3L02	Basic Mechanical Engineering Lab	0
27	3	201MI3L03	Mine Surveying Lab -I	0
28	3	201SO3L09	Geo-Statistics through SURPAC	20
29	3	201MC3T03	Biology for Engineers	0
30	4	201BS4T17	Complex Variables and Statistical Methods	0
31	4	201MI4T04	Fundamentals of Rock Mechanics	0
32	4	201MI4T05	Surface Mining	0
33	4	201MI4T06	Underground Coal Mining Technology	0
34	4	201BS4T18	Managerial Economics and Financial Accountancy	0
35	4	201MI4L04	Rock Mechanics Lab	0
36	4	201MI4L05	Mine Surveying Lab -II	0
37	4	201SC4L20	Data Analytics for Mining using Python	100
38	4	201MC4T04	Essence of Indian Traditional Knowledge	0
39	5	191MI5T09	Mine Systems Engineering	0
40	5	191MI5T10	Underground Metal Mining Technology	0
41	5	191MI5T11	Mine Environment & Ventilation Engineering	10
42	5	191MI5T12	Mine Machinery	10
43	5	191MI5E02	Environmental Impact Assessment	0
44	5	191MI5E03	Planning of Underground Coal Mining Project	0
45	5	191MI5E04	Sustainable Mining	100
46	5	191MI5E01	Drilling & Blasting	0

47	5	191CE5O01	Basic Concrete Technology	100
48	5	191EE5O01	Electrical Safety	100
49	5	191EE5O02	Electrical Materials	100
50	5	191EE5O03	Basic Electrical Measurements	100
51	5	191ME5O01	Renewable Energy Sources	100
52	5	191ME5O02	Fundamentals of Mechanical Engineering	100
53	5	191ME5O03	Supply Chain Management	100
54	5	191ME5O04	3D Printing	100
55	5	191ME5O05	Entrepreneurship Development and Incubation	100
56	5	191EC5O01	Signals and Systems	100
57	5	191EC5O02	Digital Electronics and Logic Design	100
58	5	191EC5O03	Semi conductor devices	100
59	5	191CS5O01	Data Structures	100
60	5	191CS5O01	Object Oriented Programming through C++	100
61	5	191CS5O03	Java Programming	100
62	5	191CS5O04	R Programming	100
63	5	191IT5O01	Database Management Systems	100
64		191IT5O02	Computer Graphics	100
65	5	191PT5O01	Process Intensification in Petroleum Industry	100
66	5	191PT5O02	Fundamentals of Petroleum Industry	100
67	5	191AG5O01	Basic Crop Production Practices	100
68	5	191MI5L04	Mine Environment & Ventilation Engineering Lab	0
69	5	191HS5T06	Employability Skills – III	0
70	5	191PR5P02	Socially Relevant Project	100
71	5	191MC5A08	Intellectual Property Rights and Patents	
72	6	191MI6T13	Mineral Processing Technology	30
73	6	191MI6T14	Mine Hazards & Rescue	15

74	6	191MI6T15	Environmental Management in Mines	100
75	6	191MI6E06	Mine Health & Safety Engineering	0
76	6	191MI6E07	Planning of Underground Metal Mining Project	0
77	6	191MI6E05	Green Mining	100
78	6	191MI6E08	Rock Fragmentation Engineering	0
79	6	191MI6E10	Environmental Pollution and Control	5
80	6	191MI6E11	Planning of Surface Mining Project	0
81	6	191MI6E09	Deep Sea Mining	0
82	6	191MI6E12	Rock Excavation Engineering	20
83	6	191CE6O02	Disaster Management	100
84	6	191EE6O04	Energy Audit and Conservation Management	100
85	6	191EE6O05	Non-Conventional Energy Sources	100
86	6	191EE6O06	Instrumentation	100
87	6	191ME6O06	Solar Energy Utilisation	100
88	6	191ME6O07	Basic Thermodynamics and Heat Transfer	100
89	6	191ME6O08	Introduction to Hydraulics and Pneumatics	100
90	6	191ME6O09	3D Printing	100
91	6	191ME6O10	Robotics	100
92	6	191ME6O11	Management Science	100
93	6	191ME6O12	Entrepreneurship Development and Incubation	100
94	6	191EC6O04	Biomedical Instrumentation	100
95	6	191EC6O05	ECAD Tools	100
96	6	191CS6O05	Python Programming	100
97	6	191CS6O06	Operating Systems	100
98	6	191CS6O07	Web Technologies	100
99	6	191CS6O08	Cyber Security	100
100	6	191CS6O09	AR / VR	100

101	6	191IT6O03	Computer Organization	100
102	6	191IT6O04	AI Tools & Techniques	100
103	6	191IT6O05	Robotic Process Automation	100
104	6	191PT6O03	Unconventional Hydrocarbon Resources	100
105	6	191PT6O04	Asset Management	100
106	6	191AG6O02	Weather forecast in Agriculture	100
107	6	191AG6O03	Bio-energy systems design and applications	100
108	6	191MI6L05	Mine Planning & Design Lab	0
109	6	191MI6L06	Mineral Processing Lab	40
110	6	191HS6T07	Employability Skills – IV	0
111	6	191MC6A09	Professional Ethics and Human Values	100
112	7	171MI7T17	Mine Economics	0
113	7	171MI7T18	Mine Health and Safety Engineering	0
114	7	171MI7T19	Mine Legislation and General Safety	0
115	7	171MI7T20	Mine Management	0
116	7	171MI7E10	Planning of UGMM Project	0
117	7	171MI7E11	Planning of UGCM Project	0
118	7	171MI7E12	Planning of Surface Mining Project	0
119	7	171MI7E13	Mine mechanization	0
120	7	171MI7E14	Advance Underground Coal Mining Technology	0
121	7	171MI7E15	Mine Blasting operation	0
122	7	171MI7L07	Mine Planning and Design Lab	0
123	7	171ES7L16	Mechanical Engineering Lab	0
124	7	171MI7P01	Industry Oriented (Internship) Minor Project	0
125	8	171MI8E16	Mine Systems Engineering	0
126	8	171MI8E17	Advance Surface Mining Technology	0
127	8	171MI8E18	Advanced Underground Metal Mining Technology	0

128	8	171EE8O05	Robotics	0
129	8	171MI8O01	Environmental Impact Assessment	0
130	8	171MI8O02	Mine Closure and Reclamation	0
131	8	171MI8O03	Fundamentals of Communication	0
132	8	171MI8O04	Remote Sensing and GIS	0
133	8	171MI8O05	Quantitative Decision Making	0
134	8	171MI8P02	Major Project	0
Total number of courses in the academic year 2021-2022				134
Number of courses having revision in syllabus content >/= 20% in the academic year 2021-2022				56
Percentage of syllabus revision carried out in the academic year 2021-2022 = (56/134)*100				41.79

Program Coordinator **Head of the Department**

Head of the Department
DEPARTMENT OF MINING ENGINEERING
ADITYA ENGINEERING COLLEGE

PROGRAM STRUCTURE

I SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201HS1T01	Communicative English	HSMC	Theory	3	0	0	3	3
201BS1T01	Differential equations and Linear algebra	BSC	Theory	3	0	0	3	3
201BS1T02	Engineering Physics	BSC	Theory	3	0	0	3	3
201ES1T03	Essential Electrical and Electronics Engineering	ESC	Theory	3	0	0	3	3
201ES1T05	Engineering Graphics	ESC	Theory	1	0	4	5	3
201HS1L01	Communicative English Lab	HSMC	Lab	0	0	3	3	1.5
201BS1L01	Engineering Physics Lab	BSC	Lab	0	0	3	3	1.5
201ES1L03	Essential Electrical and Electronics Engineering Lab	ESC	Lab	0	0	3	3	1.5
201MC1T01	Environmental Science	MC	Theory	2	0	0	2	0
			TOTAL	**15**	**0**	**13**	**28**	**19.5**

II SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS2T05	Partial Differential Equations and Vector Calculus	BSC	Theory	3	0	0	3	3
201BS2T08	Chemistry of Materials	BSC	Theory	3	0	0	3	3
201ES2T06	Engineering Mechanics	ESC	Theory	3	0	0	3	3
201ES2T08	Programming for Problem Solving Using C	ESC	Theory	3	0	0	3	3
201ES2L07	Engineering Workshop	ESC	Lab	0	0	3	3	1.5
201ES2L12	Computer Aided Drafting Lab	ESC	Lab	0	0	3	3	1.5
201HS2L02	Professional Communications Skills Lab	HSMC	Lab	0	0	3	3	1.5
201BS2L05	Engineering Chemistry Lab	BSC	Lab	0	0	3	3	1.5
201ES2L10	Programming for Problem Solving Using C Lab	ESC	Lab	0	0	3	3	1.5
201MC2T02	Constitution of India	MC	Theory	2	0	0	2	0
			TOTAL	**14**	**0**	**15**	**29**	**19.5**

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III SEMESTER

Course Code	Course Title	Course Component	Course Type	Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	Credits (C)
				Total Number of contact hours				
201BS3T14	Numerical Methods and Integral Transforms	BSC	Theory	3	0	0	3	3
201ES3T17	Basic Mechanical Engineering	ESC	Theory	3	0	0	3	3
201MI3T01	Mining Geology	PCC	Theory	3	0	0	3	3
201MI3T02	Mine Surveying	PCC	Theory	3	0	0	3	3
201MI3T03	Development of Mineral Deposits	PCC	Theory	3	0	0	3	3
201MI3L01	Geology Lab	PCC	Lab	0	0	3	3	1.5
201MI3L02	Basic Mechanical Engineering Lab	PCC	Lab	0	0	3	3	1.5
201MI3L03	Mine Surveying Lab -I	PCC	Lab	0	0	3	3	1.5
201SC3L09	**Skill Oriented Course-I** Geo-Statistics through SURPAC	SC	Proj	1	0	2	3	2
201MC3T03	Biology for Engineers	MC	Theory	2	0	0	2	0
			TOTAL	**18**	**0**	**13**	**31**	**21.5**

IV SEMESTER

Course Code	Course Title	Course Component	Course Type	Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	Credits (C)
				Total Number of contact hours				
201BS4T17	Complex Variables and Statistical Methods	BSC		3	0	0	3	3
201MI4T04	Fundamentals of Rock Mechanics	PCC		3	0	0	3	3
201MI4T05	Surface Mining	PCC		3	0	0	3	3
201MI4T06	Underground Coal Mining Technology	PCC		3	0	0	3	3
201BS4T18	Managerial Economics and Financial Accountancy	BSC		3	0	0	3	3
201MI4L04	Rock Mechanics Lab	PCC		0	0	4	4	2
201MI4L05	Mine Surveying Lab -II	PCC		0	0	3	3	2
201SC4L20	**Skill Oriented Course-II** Data Analytics for Mining using Python	SC	Proj	1	0	2	3	2
201MC4T04	Essence of Indian Traditional Knowledge	MC		2	0	0	2	0
			TOTAL	**18**	**0**	**9**	**27**	**21**

BSC: Basic Sciences Courses; HSMC: Humanities and Social Sciences including Management Courses; ESC: Engineering Sciences Courses; PCC: Professional Core Courses; SC: Skill Oriented Course; PEC: Professional Elective Courses; OEC: Open Elective Courses; MC: Mandatory Courses; PROJ: Project.

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ADITYA ENGINEERING COLLEGE (A9)

V SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	Credits (C)
191MI5T09	Mine Systems Engineering	PCC	3	0	0	3	3
191MI5T10	Underground Metal Mining Technology	PCC	3	0	0	3	3
191MI5T11	Mine Environment & Ventilation Engineering	PCC	3	0	0	3	3
191MI5T12	Mine Machinery	PCC	3	0	0	3	3
----	PE-I	PEC	3	0	0	3	3
----	OE-I	OEC	3	0	0	3	3
191MI5L04	Mine Environment & Ventilation Engineering Lab	PCC	0	0	4	4	2
191HS5T06	Employability Skills – III	HSMC	0	0	2	2	1
191PR5P02	Socially Relevant Project	PROJ	0	0	0	0	1
191MC5A08	Intellectual Property Rights and Patents	MC	2	0	0	2	0
		TOTAL	**18**	**0**	**6**	**24**	**22**

VI SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	Credits (C)
191MI6T13	Mineral Processing Technology	PCC	3	0	0	3	3
191MI6T14	Mine Hazards & Rescue	PCC	3	0	0	3	3
191MI6T15	Environmental Management in Mines	PCC	2	0	0	2	2
----	PE-II	PEC	3	0	0	3	3
----	PE-III	PEC	3	0	0	3	3
----	OE-II	OEC	3	0	0	3	3
191MI6L05	Mine Planning & Design Lab	PCC	0	0	4	4	2
191MI6L06	Mineral Processing Lab	PCC	0	0	3	3	1.5
191HS6T07	Employability Skills – IV	HSMC	0	0	2	2	1
191MC6A09	Professional Ethics and Human Values	MC	2	0	0	2	0
		TOTAL	**17**	**0**	**9**	**26**	**21.5**

VII SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	Credits (C)
191MI7T16	Mine Legislation & General Safety	PCC	3	0	0	3	3
191MI7T17	Mineral Economics	PCC	3	0	0	3	3
191MI7T18	Strata Mechanics	PCC	3	0	0	3	3
----	PE-IV	PEC	3	0	0	3	3
----	PE-V	PEC	3	0	0	3	3
----	OE-III	OEC	3	0	0	3	3
191MI7P03	Internship	PROJ	0	0	0	0	2
191MI7P04	Project Part 1	PROJ	0	0	0	0	2
		TOTAL	**6**	**0**	**0**	**18**	**22**

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VIII SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
----	PE-VI (MOOCs)	PEC	3	0	0	3	3
----	OE-IV (MOOCs)	OEC	3	0	0	3	3
191MI8P05	Project Part 2	PROJ	0	0	0	0	7
		TOTAL	6	0	0	6	13

BSC: Basic Sciences Courses; HSMC: Humanities and Social Sciences including Management Courses; ESC: Engineering Sciences Courses; PCC: Professional Core Courses; PEC: Professional Elective Courses; OEC: Open Elective Courses; SSC: Self Study Course; MC: Mandatory Courses; PROJ: Project.

PROFESSIONAL ELECTIVES

Professional Elective – I (V Semester)

S.No	Course Code	Name of the Course
1	191MI5E02	Environmental Impact Assessment
2	191MI5E03	Planning of Underground Coal Mining Project
3	191MI5E04	Sustainable Mining
4	191MI5E01	Drilling & Blasting

Professional Elective – II (VI Semester)

S.No	Course Code	Name of the Course
1	191MI6E06	Mine Health & Safety Engineering
2	191MI6E07	Planning of Underground Metal Mining Project
3	191MI6E05	Green Mining
4	191MI6E08	Rock Fragmentation Engineering

Professional Elective – III (VI Semester)

S.No	Course Code	Name of the Course
1	191MI6E10	Environmental Pollution & Control
2	191MI6E11	Planning of Surface Mining Project
3	191MI6E09	Deep Sea Mining
4	191MI6E12	Rock Excavation Engineering

Professional Elective – IV (VII Semester)

S.No	Course Code	Name of the Course
1	191MI7E16	Safety Practices in Mines
2	191MI7E14	Planning for Mine Closure & Reclamation
3	191MI7E13	Geo Spatial Imaging & Geo-informatics
4	191MI7E15	Rock Slope Technology

Professional Elective – V (VII Semester)

S.No	Course Code	Name of the Course
1	191MI7E18	Industrial Safety
2	191MI7E19	Mine Closure & Reclamation
3	191MI7E20	Space Mining Technology
4	191MI7E17	Ground Control

Professional Elective – VI (VIII Semester)

S.No	Course Code	Name of the Course
1	191MI8E24	Waste Water Treatment and Recycling
2	191MI8E21	Advance Surveying Technology
3	191MI8E23	Solar Energy Utilisation
4	191MI8E22	Flow through porous media

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PROFESSIONAL ELECTIVE TRACKS

Track		Professional Elective I	Professional Elective II	Professional Elective III	Professional Elective IV	Professional Elective V	Professional Elective VI
Track 1	Environment & Safety	Environmental Impact Assessment	Mine Health & Safety Engineering	Environmental Pollution & Control	Safety Practices in Mines	Industrial Safety	Waste Water Treatment and Recycling
Track 2	Mine Planning	Planning of Underground Coal Mining Project	Planning of Underground Metal Mining Project	Planning of Surface Mining Project	Planning for Mine Closure & Reclamation	Mine Closure & Reclamation	Advance Surveying Technology
Track 3	Innovative Mining	Sustainable Mining	Green Mining	Deep Sea Mining	Geo Spatial Imaging & Geo-informatics	Space Mining Technology	Solar Energy Utilisation
Track 4	Geo Mechanics	Drilling & Blasting	Rock Fragmentation Engineering	Rock Excavation Engineering	Rock Slope Technology	Ground Control	Flow through porous media

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OPEN ELECTIVE - I (V Semester)

S. No	Course Code	Course Name	Not Offered to Branches	Offered By Department
1	191CE5O01	Basic Concrete Technology	CE, EEE	CE
2	191EE5O01	Electrical Safety	EEE	EEE
3	191EE5O02	Electrical Materials	EEE	EEE
4	191EE5O03	Basic Electrical Measurements	EEE, ECE	EEE
5	191EE5O03	Renewable Energy Sources	CE, EEE, ME, Ag. E	ME
6	191ME5O02	Fundamentals of Mechanical Engineering	ME	ME
7	191ME5O03	Supply Chain Management	ME	ME
8	191ME5O04	3D Printing	ME	ME
9	191ME5O05	Entrepreneurship Development and Incubation		ME
10	191EC5O01	Signals & Systems	EEE, ECE	ECE
11	191EC5O02	Digital Electronics and Logic Design	EEE, ECE, CSE, IT	ECE
12	191EC5O03	Semi conductor devices	EEE, ECE	ECE
13	191CS5O01	Data Structures	EEE, ECE, CSE, IT	CSE
14	191CS5O02	Object Oriented Programming through C++	CSE, IT	CSE
15	191CS5O03	Java Programming	CSE, IT	CSE
16	191CS5O04	R Programming		CSE
17	191IT5O01	Data Base Management Systems	CSE, IT	IT
18	191IT5O02	Computer Graphics	CSE, IT	IT
19	191MI5O01	Overview of Mining	Min.E	Min.E
20	191PT5O01	Process Intensification in Petroleum Industry	PT	PT
21	191PT5O02	Fundamentals of Petroleum Industry	PT	PT
22	191AG5O01	Basic Crop Production Practices	Ag.E	Ag.E

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OPEN ELECTIVE - II (VI Semester)

S. No	Course Code	Course Name	Not Offered to Branches	Offered By Department
1	191CE6O02	Disaster Management		CE
2	191EE6O04	Energy Audit and Conservation Management	EEE	EEE
3	191EE6O05	Non Conventional Energy resources	EEE	EEE
4	191EE6O06	Instrumentation	EEE, ECE, Ag. E	EEE
5	191ME6O06	Solar Energy Utilisation	ME, Ag. E	ME
6	191ME6O07	Basic Thermodynamics and Heat Transfer	EEE, ME, PT, Ag.E, Min.E	ME
7	191ME6O08	Introduction to Hydraulics and Pneumatics	CE, ME, PT	ME
8	191ME6O09	3D Printing	ME	ME
9	191ME6O10	Robotics	ME	ME
10	191ME6O11	Management Science	CE, CSE, IT, PT, Min. E	ME
11	191ME6O12	Entrepreneurship Development and Incubation		ME
12	191EC6O04	Biomedical Instrumentation		ECE
13	191EC6O05	ECAD Tools	ECE	ECE
14	191CS6O05	Python Programming	EEE, CSE, IT	CSE
15	191CS6O06	Operating Systems	CSE, IT	CSE
16	191CS6O07	Web Technologies	CSE, IT	CSE
17	191CS6O08	Cyber Security	CSE, IT	CSE
18	191CS6O09	AR / VR		CSE
19	191IT6O03	Computer Organization	CSE, IT	IT
20	191IT6O04	AI Tools & Techniques	CSE, IT	IT
21	191IT6O05	Robotic Process Automation		IT
22	191MI6O02	Industrial Safety Practices	Ag.E	Min.E
23	191MI6O03	Electrical Equipment's in Mines		Min.E
24	191PT6O03	Unconventional Hydrocarbon Resources	PT	PT
25	191PT6O04	Asset Management		PT
26	191AG6O02	Weather forecast in Agriculture		Ag.E
27	191AG6O03	Bio-energy systems design and applications		Ag.E

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OPEN ELECTIVE - III (VII Semester)

S. No	Course Code	Course Name	Not Offered to Branches	Offered By Department
1	191CE7O03	Waste Water Management	CE	CE
2	191EE7O07	Electrical and Hybrid Vehicles	EEE	EEE
3	191EE7O08	Special Electrical Machines	EEE	EEE
4	191EE7O09	Industrial Electrical Systems	EEE	EEE
5	191ME7O13	Optimization techniques		ME
6	191ME7O14	Energy Conservation		ME
7	191ME7O15	Introduction to Material Handling Systems		ME
8	191ME7O16	Robotics	ME	ME
9	191ME7O17	Entrepreneurship Development and Incubation		ME
10	191EC7O06	Overview of Digital Signal Processing	EEE, ECE	ECE
11	191EC7O07	Basics of VLSI Design	ECE	ECE
12	191EC7O08	Micro Electro Mechanical Systems		ECE
13	191EC7O09	Image Processing	ECE, CSE, IT	ECE
14	191CS7O10	Big Data Analytics	CSE, IT	CSE
15	191CS7O11	Mobile Application Development	CSE, IT	CSE
16	191CS7O12	Data Science	CSE, IT	CSE
17	191IT7O06	Machine Learning	CSE, IT	IT
18	191IT7O07	Quantum Computing		IT
19	191IT7O08	Block Chain Technologies	CSE, IT	IT
20	191MI7O04	Communication System in Mines		Min.E
21	191MI7O05	Drilling & Blasting	Min.E	Min.E
22	191PT7O05	Introduction to Earth Sciences	CE, PT, Min. E	PT
23	191PT7O06	Basic Concepts in Petroleum Drilling and Completions	PT	PT
24	191AG7O04	Greenhouse Technology		Ag.E
25	191AG7O05	Floods and Control Measures	CE	Ag.E

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OPEN ELECTIVE – IV (VIII Semester)

S. No	Course Code	Course Name	Not Offered to Branches	Offered By Department
1	191CE8O04	Integrated Waste Management for a Smart City		CE
2	191EE8O10	Fundamentals of Electrical Engineering	EEE, ECE	EEE
3	191EE8O11	Basic Electrical Circuits	EEE, ECE	EEE
4	191EE8O12	Electrical Machines	EEE	EEE
5	191EE8O13	Power Electronics	EEE	EEE
6	191EE8O14	Non-Conventional Energy Sources	CE, EEE, ME	EEE
7	191ME8O18	Fabrication processes	ME	ME
8	191ME8O19	Smart Materials		ME
9	191EC8O10	Micro Electro Mechanical Systems		ECE
10	191EC8O11	Basic Electronic Circuits	EEE & ECE	ECE
11	191EC8O12	Principles of Communications	ECE	ECE
12	191EC8O13	Electronic Instrumentation	EEE & ECE	ECE
13	191EC8O14	Digital Image Processing	ECE, CSE, IT	ECE
14	191CS8O13	Cyber Security	CSE, IT	CSE
15	191CS8O14	Data Science	CSE, IT	CSE
16	191IT8O12	Game Programming		IT
	191IT8O11	Cloud Computing	CSE,IT	CSE
17	191CS8O16	AR / VR		CSE
18	191IT8O09	Deep learning	CSE, IT	IT
19	191IT8O10	Block Chain Technologies	CSE, IT	IT
20	191PT8O07	Chemical Process Safety		PT
21	191PT8O08	Mechanical Unit Operations		PT
22	191AG8O06	Application of RS and GIS in Land and Water Resources Management	CE	Ag.E
23	191AG8O07	Plastic Applications in Agriculture		Ag.E

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V SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
171MI5T09	Under Ground Coal Mining Technology	PC	3	1	0	4	3
171MI5T10	Mine Environment Engineering - I	PC	3	1	0	4	3
171MI5T11	Basic Geo Mechanics	PC	3	1	0	4	3
171MI5T12	Mine Surveying - II	PC	3	1	0	4	3
171HS5T04	Managerial Economics and Financial Analysis	HSS	3	1	0	4	3
---	**Professional Elective – I**	PE	3	1	0	4	3
171HS5T06	Employability Skills – III	HSS	0	0	2	2	1
171MI5L03	Rock Mechanics Lab	PC	0	0	3	3	2
171MI5L04	Mine Surveying Lab	PC	0	0	3	3	2
171MI5S01	MOOCs - I	SS	0	0	0	0	0
TOTAL			**18**	**6**	**8**	**32**	**23**

VI SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
171MI6T13	Under Ground Metal Mining Technology	PC	3	1	0	4	3
171MI6T14	Mineral Processing Technology	PC	3	1	0	4	3
171MI6T15	Mine Environment Engineering - II	PC	3	1	0	4	3
171MI6T16	Mining Machinery	PC	3	1	0	4	3
---	**Professional Elective – II**	PE	3	1	0	4	3
---	**Professional Elective - III**	PE	3	1	0	4	3
171HS6T07	Employability Skills - IV	HSS	0	0	2	2	1
171MI6L05	Mineral Processing Technology Lab	PC	0	0	3	3	2
171MI6L06	Environmental Engineering Lab	PC	0	0	3	3	2
171MI6S02	MOOCs - II	SS	0	0	0	0	0
TOTAL			**18**	**6**	**8**	**32**	**23**

MOOCs – Massive Open Online Courses

VII SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
171MI7T17	Mine Economics	PC	3	1	0	4	3
171MI7T18	Mine Health and Safety Engineering	PC	3	1	0	4	3
171MI7T19	Mine Legislation and General Safety	PC	3	1	0	4	3
171MI7T20	Mine Management	PC	3	1	0	4	3
---	**Professional Elective - IV**	PE	3	1	0	4	3
---	**Professional Elective - V**	PE	3	1	0	4	3
171MI7L07	Mine Planning and Design Lab	PC	0	0	3	3	2
171ES7L16	Mechanical Engineering Lab	ES	0	0	3	3	2
171MI7P01	Industry Oriented (Internship) Minor Project	PR	0	0	0	0	1
TOTAL			**18**	**6**	**6**	**30**	**23**

VIII SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
---	**Professional Elective - VI**	PE	3	1	0	4	3
---	**Open Elective**	OE	3	1	0	4	3
171MI8P02	**Major Project**	PR	0	0	0	0	14
TOTAL			**6**	**2**	**0**	**8**	**20**

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Professional Elective – I (V Semester)

S.No	Course Code	Name of the Course
1	171MI5E01	Maintenance and Reliability Engineering
2	171MI5E02	Mine Construction and Management
3	171MI5E03	Industrial Management and Labor Relations

Professional Elective – II (VI Semester)

S.No	Course Code	Name of the Course
1	171MI6E04	Advanced Geo Mechanics
2	171MI6E05	Mine Fire and Spontaneous Heating
3	171MI6E06	Mineral Exploration

Professional Elective – III (VI Semester)

S.No	Course Code	Name of the Course
1	171MI6E07	Advance Surveying Technology
2	171MI6E08	Mine Subsidence Engineering
3	171MI6E09	Rock Fragmentation Engineering

Professional Elective – IV (VII Semester)

S.No	Course Code	Name of the Course
1	171MI7E10	Planning of UGMM Project
2	171MI7E11	Planning of UGCM Project
3	171MI7E12	Planning of Surface Mining Project

Professional Elective – V (VII Semester)

S.No	Course Code	Name of the Course
1	171MI7E13	Mine mechanization
2	171MI7E14	Advance Underground Coal Mining Technology
3	171MI7E15	Mine Blasting operation

Professional Elective – VI (VIII Semester)

S.No	Course Code	Name of the Course
1	171MI8E16	Mine Systems Engineering
2	171MI8E17	Advance Surface Mining Technology
3	171MI8E18	Advanced Underground Metal Mining Technology

Open Elective (VIII Semester)

S.No	Course Code	Name of the Course
1	171EE8O05	Robotics
2	171MI8O01	Environmental Impact Assessment
3	171MI8O02	Mine Closure and Reclamation
4	171MI8O03	Fundamentals of Communication
5	171MI8O04	Remote Sensing and GIS
6	171MI8O05	Quantitative Decision Making

GEO-STATISTICS THROUGH SURPAC

III Semester
Course Code: 201SC3L09

L	T	P	C
1	0	2	2

Course Outcomes: At the end of the Course, Student will be able to:

- CO1: Learn about arithmetic mean, median ,mode etc.
- CO2: Gain knowledge on theories of probabilities.
- CO3: Analyze types of sampling.
- CO4: Able to estimate deposits.
- CO5: Able to estimate deposits with surpac.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	1	3	-	-	-	-	-	-	-	-	-	-
CO2	1	3	-	-	-	-	-	-	-	-	-	-
CO3	1	3	1	-	-	-	-	-	-	-	-	-
CO4	1	3	-	-	1	-	-	-	-	-	-	-
CO5	1	3	1	-	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	-	3	-
CO2	-	3	-
CO3	-	3	-
CO4	-	3	-
CO5	-	3	-

Unit - I

Introduction to Statistics: Arithmetic mean; Median; Mode; Standard deviation; Mean deviation or the average deviation; coefficient of variance; coefficient of correlation; Rank correlation. Probability distribution function; Normal distribution function; Poisson distribution function; Exponential distribution; Expectation of a variance.

Unit – II

Theories of Probability: Additional theory of probability; Theorem of total probability for compound events; Bay's theorem; Mean square error.

Unit – III

Sampling: Type of sampling, Methods of sampling- grab sampling, channel sampling, chip sampling, face sampling, bulk sampling, drill hole sampling, Error in sampling.

Unit – IV

Reserve Estimation: Traditional Approaches to Reserve EstimationTonnage factor; Determination of average grade of ore in a vertical section; Determination of average grade of ore in a horizontal section- Triangular method, Polygonal method, Constant distance weighting technique, Inverse distance weighting technique.
Geo-statistical approach for reserve estimation

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Unit – V

Introduction to SURPAC:Determination lease boundaries using bearings and distance. Determination of lease boundaries using co-ordinates. DTM surface from a String File. Introduction to Geological data. Creation of Geological Data Base, Generation and displaying of drill holes, Creation of 3-D Block Model. Calculation of volume and tonnage using string file.

Text Books:

1. Geo informatics & Geo-statistics- N.M. Naidu
2. Applied Geo-statistics – Isaaks, Edward H.

Reference Books:

1. Mineral Deposit Evaluation a practical approach by Alwyn E. Annels.
2. Geostatistical Ore Reserve Estimation by Michel David.

Web Links:

1. https://baixardoc.com/documents/surpac - introduction - tutorial - system software - technology -5dbde76f19168
2. https://pdfcoffee.com/surpac-tutorialpdf-pdf-free.html

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MINERAL PROCESSING TECHNOLOGY

VI Semester **L T P C**
Course Code: 191MI6T13 **3 0 0 3**

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1: Illustrate the fundamentals of mineral processing.
CO 2: Examine size separation of float & sink analysis of coal.
CO 3: Analyze methods of froth flotation and settling of particles.
CO 4: Explain Flocculation and separation methods of minerals.
CO 5: Explain Hydro metallurgical methods of concentration.

Mapping of course outcomes with program outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	1	1	-	-	-	-	-	-	-	-	-	-
CO4	1	1	-	-	-	-	-	-	-	-	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-

Mapping of course outcomes with program Specific Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3
CO1	-	3	-
CO2	-	3	-
CO3	-	3	-
CO4	-	3	-
CO5	-	3	-

UNIT-I:
Introduction- Scope, objectives and limitations of mineral processing; liberation and beneficiation of minerals; Characteristics of mineral and coal.
Comminution- Theory and practice of crushing and grinding; Different types of crushing and grinding equipment- application and limitations.

UNIT-II:
Size Separation- Laboratory size analysis and interpretation, different types of industrial screen and screening efficiency; Theory and practice of classification, classifiers their performance and choice, Classifier efficiency.
Float and Sink analysis- Theory of float and sink of mineral and coal, washability analysis of coal, Tromp curve of coal

UNIT-III:
Mechanics of settling of particle - Terminal settling velocity, Equal settling particle, hindered settling; Hydro cyclone- concept and mechanism, types of hydro cyclone
Dense medium separation Mechanism of dense media separation; Jigging-

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Mechanism, cycle, variable in operation etc. Baum jig, Harz and other types of Jigs.
Tabling - Wilfley and other types of tabling operation, Material used for suspension, Separating vessels and their relative merits and demerits.
Froth flotation- Principle, flotation reagents, flotation machines and circuits, application to common sulphide, oxides and oxidized mineral.

UNIT-IV:
Flocculation and thickners- Principle of flocculation, types of flocculants, design features of thickners, vanners and their application
Dewatering and Drying- Filtration- pressure and suction filters, their relative merits and demerits, filter and filtration cycle; Drying- rate of drying, compartment, rotary and other types of dryer and their operational features.
Magnetic Separation- Paramagnetic and diamagnetic substances, Industrial magnetic separator and their selection criteria.
Electrical Separation of Minerals- Electrostatic and electrodynamic methods, plate and roll type separators. Factor affecting design of high tension roll separators. Electrostatic precipitation. Single and two stage separations. Operation features of ESMS such as Cottrell precipitator.

UNIT-V:
Hydro-metallurgical methods of concentration- Leaching- principle, various methods and applications.
Flow sheet design- Flowsheet for coal,copper, lead, zinc, gold, manganese and limestone

Text Books:
1. A.M.Gaudin. Principles of Mineral Dressing, Tata McGraw & Hill, 1939
2. R.H. Richard and C.E. Locky

Reference Books:
1. F.Taggart, Mineral Dressing Hand book, P& H,2000
2. B.A.Wills, Mineral Processing,TechnologyWilly&Sons,2005

Web Links:
1. https://www.britannica.com/technology/mineral-processing
2. http://met-solvelabs.com/library/articles/mineral-processing-introduction
3. http://www.nmlindia.org/mnp.html
4. http://ibm.nic.in/index.php?c=pages&m=index&id=81&mid=22090

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ENVIRONMENTAL POLLUTION AND CONTROL
Professional Elective – III

Semester	**VI**	**L**	**T**	**P**	**C**
Course Code:	**191MI6E10**	**3**	**0**	**0**	**3**

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1: Illustrate the fundamentals of environmental issues in mining.
CO 2: Examine the various causes of water pollution.
CO 3: Analyze the various causes of air pollution.
CO 4: Analyze the methods for mine reclamation.
CO 5: Asses socio economic and environmental impact due to mining.

Mapping of course outcomes with program outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	3	1	-	-	-	-	-	-	-	1	1	-
CO2	3	1	-	1	1	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	3	-	-	1	-	-	-	-	-	-	-
CO5	-	3	-	1	-	-	-	-	-	-	-	-

Mapping of course outcomes with program Specific Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3
CO1	-	3	-
CO2	-	3	-
CO3	-	3	-
CO4	-	3	-
CO5	-	3	-

UNIT-I:
Air Pollution
Atmospheric science; Sources of air pollution in mines; Effect of air pollution and preventive measures; Ozone layer and greenhouse effect; Dispersion model.

UNIT-II:
Water Pollution
Sources of water pollution; Effect and preventive measures of water pollution; Ground water and its contamination; Water pollution modeling - biological oxygen demand and chemical oxygen demand; Acid mine drainage; Waste water treatment

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UNIT-III:

Noise Pollution

Terminologies associated with noise; Sources and effects of noise; Measurement of noise; Noise standard and guidelines; Noise control strategies.

UNIT-IV:

Land Degradation

Causes of land degradation; Land reclamation method- Rehabilitation, Reclamation, Restoration; Factor affecting the land restoration; Land reclamation planning.

UNIT-V:

Socio-Economic Impact Assessment

Socio-economic impact of mining, Quality of life index.

Text Books:

1. P. G. Hutchison, and R. D. Ellison, Mine Waste Management, CRC Press, 1st edition, 1992
2. Principle and practices of modern coal mining by R.D. Singh, New Age International Publishers

Reference Books:

1. Peng, S.S. Ground Control, Wiley Publications, New York, 1987
2. Brady, B.H.G. and Brown, S.T. Rock Mechanics for Underground Mining, Chapman and Hall, 1993
3. Hoek, E. and Brown, S.T. Underground Excavations in Rocks, Institute of Mining Metallurgy, London, 1980

Web Links:

1. https://miningandblasting.wordpress.com/2011/10/01/challenges-in-mine-planning- and-scheduling
2. http://www.fipr.state.fl.us/about-us/phosphate-primer/reclamation-strategies-and-stages

ROCK EXCAVATION ENGINEERING
Professional Elective – III

Semester	**VI**	**L**	**T**	**P**	**C**
Course Code:	**191MI6E12**	**3**	**0**	**0**	**3**

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1: Explain general theory of rock cutting and classification of drilling system.
CO 2: Explain the mechanics of rotary drilling.
CO 3: Illustrate the mechanism of rock fragmentation and fracture by explosive action.
CO 4: Distinguish the blasting parameters
CO 5: Explain the impact of ground vibration and air over pressure.

Mapping of course outcomes with program outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	2	3	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	2	-	-	-	-	-	-	-	-
CO3	2	3	1	2	-	-	-	-	-	-	-	-
CO4	2	3	-	-	-	-	-	-	-	3	-	-
CO5	2	3	-	-	-	-	-	-	-	-	-	-

Mapping of course outcomes with program Specific Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3
CO1	-	3	-
CO2	-	3	-
CO3	-	3	-
CO4	-	3	-
CO5	-	3	-

UNIT-I:
Introduction
Concepts and historical developments and design in rock excavation, factors affecting rock fragmentation, mechanism of rock breakage and fractures. Rock Fragmentation: Method of rock fragmentation - explosive action, cutting, ripping and impacts

UNIT-II:
Physio- Mechanical Properties of Rocks
Application 'of compression, tensile and multi - axial strength, index test and abrasivity, anisotropy, elasticity, porosity, lamination, bedding joints in rock fragmentation process.

UNIT-III:
Principles of Rock Cutting Technology: Drilling and its various types i.e., rotary, percussive; rotary - percussive mechanism of rock percussion, theory of single tool

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rock cutting, crack initiation, propagation and breakage pattern.

Drillability

Drillability index, rock cutting picks, discs and rolls cutter. Water jet cutting, Jet piercing technique, determination of Drillability index

UNIT-IV:

Equipments for Rock Excavation

Excavation in surface mines- Shovel, Dragline and Bucket Wheel Excavators, Surface miner Excavation in underground mines- Continuous miners, Road headers, TBM, Coal face cutters, Loaders

UNIT-V:

Rock Çutting Tools

Cutting tool material – types, relative application and their choice, tool shape and size, specific energy consumption, tool wear.

Text Books:

1. Principles of Rock Fragmentation, GB.Clark, John wiley and Sons, New York,1987.
2. Rock mechanics and Design of structures, Obert and duvval, John wiley and Sons, New York.

Reference Books:

1. SME mining engineering hand book, Hartman, Society for Mining, Metallurgy and Exploration.
2. Hartman, H.L., Introductory Mining Engineering, John Wiley and Sons, New York, 1987.
3. Cummings, A.B. and Given, I.V., SME Mining Engg. Vol. I and II, Society of Mining Engineers, America, 1992.
4. Chugh, C.P., Diamond Drilling, Oxford-IBH, 1984.
5. Clark, G.B., Principles of Rock Fragmentation, John Wiley and Sons, New York, 1987.

Web Links:

1. https://www.researchgate.net/publication/316158230_rock_blasting_for_mining
2. https://miningandblasting.files.wordpress.com/2009/09/rock-excavation_compiled- by_dr-sean-dessureault.pdf

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MINERAL PROCESSING LAB

Semester	VI	L	T	P	C
Course Code:	191MI6L06	0	0	3	1.5

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1: Illustrate the fundamentals of mineral processing technology.
CO 2: Categorize material by sieve analysis.
CO 3: Select various mineral crushers
CO 4: Choose the various mineral separators.
CO 5: Analyze the mineral processing techniques

Mapping of course outcomes with program outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	1	1	1
CO2	3	2	-	-	-	-	-	-	-	1	1	1
CO3	3	2	-	-	-	-	-	-	-	1	1	1
CO4	3	2	-	-	-	-	-	-	-	1	1	1
CO5	3	2	-	-	-	-	-	-	-	1	1	1

Mapping of course outcomes with program Specific Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-

List of Experiments:

1. To do Sampling by Using Conning and quartering and John Riffle and calculation of error
2. Determination of various sized product by using different Sieve shaker
3. Determination of average size reduction by Jaw crusher and study their theoretical and actual capacity
4. Determination of average size by sieving of crushed Ore sample in roller crusher.
5. To study the effect of grinding with grinding time in Ball mill.
6. To study the effect of grinding with frequency (RPM) in Ball mill.
7. Determination of Washability Curve by using Float -sink analysis.,
8. Determination of Proximate analysis of coal.
9. Perform the beneficiation of an Oxide ore pulp mix using Floatation Cell.
10. Perform the beneficiation of a sulphide ore pulp mix using Floatation cell
11. Study of magnetic separator, and effect of magnetic field on efficiency of the process.
12. Perform the Jigging operation to detecting the rate of stratification.

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List of Augmented Experiments: (Weeks 13 – Week 16)
(Any two of the following experiments can be performed)

1. Crushing of Coal in the Jaw Crusher, and Determination of average size by sieving.
2. Determine the theoretical capacity and actual capacity of a roller crusher.
3. Compare the reduction ratio of an ore sample and the coal sample.
4. Determine the reduction ratio of a coal sample in Jaw Crusher.
5. Determine the reduction ratio of a coal sample in Ball mill.

Text Books

1. A.M.Gaudin, Principles of Mineral Dressing, TataMcGraw &Hill,1939.
2. R.H.RichardandC.E.Locky,AtextBookonOre.

Reference Books:

1. F.Taggart, Mineral Dressing Handbook, P& H, 2000.
2. B. A.Wills, Mineral Processing Technology, Willy & Sons, 2005.

Web Links:

1. https://www.britannica.com/technology/mineral-processing
2. http://met-solvelabs.com/library/articles/mineral-processing-introduction
3. http://www.nmlindia.org/mnp.html
4. http://ibm.nic.in/index.php?c=pages&m=index&id=81&mid=22090

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Department of Mining Engineering

Syllabus revision Index

Academic Year 2021-2022

S.No	Name of the course	Percentage of syllabus change
1	Geo-Statistics through SURPAC	20
2	Mineral Processing Technology	30
4	Rock Excavation Engineering	20
5	Mineral Processing Lab	40

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Geo-statistics	Geo-Statistics through SURPAC
Course Code	191MI4T08	201SO3L09
Syllabus	UNIT – I Introduction to Statistics Arithmetic mean; Median; Mode; Standard deviation; Mean deviation or the average deviation; coefficient of variance; coefficient of correlation; Rank correlation. Probability distribution function; Normal distribution function; Poisson distribution function; Exponential distribution; Expectation of a variance. Skewness.	UNIT-I: Introduction to Statistics: Arithmetic mean; Median; Mode; Standard deviation; Mean deviation or the average deviation; coefficient of variance; coefficient of correlation; Rank correlation. Probability distribution function; Normal distribution function; Poisson distribution function; Exponential distribution; Expectation of a variance
	UNIT – II Theories of Probability Additional theory of probability; Theorem of total probability for compound events; Bay's theorem; Mean square error; Cramer Rao theorem for evaluating estimator.	UNIT-II: Theories of Probability: Additional theory of probability; Theorem of total probability for compound events; Bay's theorem; Mean square error.
	UNIT – III Sampling Sampling definition and its equipment, Type of sampling, Methods of sampling-grab sampling, channel sampling, chip sampling, face sampling, bulk sampling, drill hole sampling, Error in sampling, 4 step sampling technique.	UNIT-III: Sampling: Type of sampling, Methods of sampling- grab sampling, channel sampling, chip sampling, face sampling, bulk sampling, drill hole sampling, Error in sampling.
	UNIT – IV Traditional Approaches to Reserve Estimation Tonnage factor; Determination of average grade of ore in a vertical section; Determination of average grade of ore in a horizontal section- Triangular method, Polygons method, Constant distance weighting technique, Inverse distance weighting technique.	UNIT-IV: Reserve Estimation: Traditional Approaches to Reserve Estimation Tonnage factor; Determination of average grade of ore in a vertical section; Determination of average grade of ore in a horizontal section- Triangular method, Polygonal method, Constant distance weighting technique, Inverse distance weighting technique. Geo-statistical approach for reserve estimation Krigging

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	UNIT – V Statistical Approach to Reserve Estimation Application of statistics on the orebody; Global and Local estimation; Point and Block estimates; Random variables; Random function; Variogram; Quantification of deposits through variogram.	**UNIT-V:** Introduction to SURPAC: Determination lease boundaries using bearings and distance. Determination of lease boundaries using co-ordinates. DTM surface from a String File. Introduction to Geological data. Creation of Geological Data Base, Generation and displaying of drill holes, Creation of 3-D Block Model. Calculation of volume and tonnage using string file.

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Regulation	Pre-Revision	Post-Revision
Course Title	Mineral Processing Technology	Mineral Processing Technology
Course Code	171MI6T14	191MI6T13
Syllabus	**UNIT-I** Introduction to Mineral Processing: General Principle: Mineral Beneficiation and its role in mineral exploitation.; Comminution and Liberation: Theory. And practice of crushing and grinding and practice of crushing and grinding, performance and choice of crushers and grinding mills	**UNIT-I** Introduction- Scope, objectives and limitations of mineral processing; liberation and beneficiation of minerals; Characteristics of mineral and coal. Comminution- Theory and practice of crushing and grinding; Different types of crushing and grinding equipment- application and limitations.
	UNIT – II: Mineral Screening: Laboratory techniques, Industrial screens and screening efficiency; concentration: Theory and practice of classification, classifiers Their performance and choice, Picking and washing techniques.	**UNIT-II** Size Separation- Laboratory size analysis and interpretation, different types of industrial screen and screening efficiency; Theory and practice of classification, classifiers their performance and choice, Classifier efficiency. Float and Sink analysis- Theory of float and sink of mineral and coal, washability analysis of coal, Tromp curve of coal
	UNIT – III: Mineral Separation: Theory and application of sink and float, jigging and flowing mil concentration- methods and equipment used; Froth Flotation: Physio chemical principles, flotation reagents, flotation machines and circuits, application to common sulphides, oxides and oxidized minerals.	**UNIT-III** Mechanics of settling of particle - Terminal settling velocity, Equal settling particle, hindered settling; Hydrocyclone- concept and mechanism, types of hydro cyclone Dense medium separation Mechanism of dense media separation; Jigging Mechanism, cycle, variable in operation etc. Baum jig, Harz and other types of Jigs. Tabling - Wilfley and other types of tabling operation, Material used for suspension, Separating vessels and their relative merits and demerits. Froth flotation- Principle, flotation reagents, flotation machines and circuits, application to common sulphide, oxides and oxidized mineral
	UNIT – IV: Modern Mineral Separators: Electrostatic and Electro-Magnetic Separation- Principles, operations and fields of applications.	**UNIT-IV** Flocculation and thickners- Principle of flocculation, types of flocculants, design features of thickners, vanners and their application Dewatering and Drying- Filtration- pressure and suction filters, their relative merits and demerits, filter and filtration cycle; Drying- rate of drying, compartment, rotary and other types of dryer and their operational features. Magnetic Separation- Paramagnetic and diamagnetic substances, Industrial

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		magnetic separator and their selection criteria. Electrical Separation of Minerals- Electrostatic and electrodynamic methods, plate and roll type separators. Factor affecting design of high tension roll separators. Electrostatic precipitation. Single and two stage separations. Operation features of ESMS such as Cottrell precipitator.
	<u>UNIT – V</u>: Flow Charts for Various Mineral Processing: Simplified flow sheets for the beneficiation of beachs and, coal and typica lores of copper, lead, zinc and manganese with special reference to India and deposits.	<u>UNIT-V</u> Hydro-metallurgical methods of concentration- Leaching- principle, various methods and applications. Flow sheet design- Flowsheet for coal, copper, lead, zinc, gold, manganese and limestone

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Regulation	Pre-Revision	Post-Revision
Course Title	Rock Fragmentation Engineering	Rock Excavation Engineering
Course Code	171MI6E09	191MI6E12
Syllabus	UNIT-I: Drilling of Rocks in Underground and Surface Mines: General theory of rock cutting, Selection of cutting tools for optimum penetration. Classification of drilling system. Rock drilling methods, parameters affecting the choice of drilling.	UNIT-I: Introduction Concepts and historical developments and design in rock excavation, factors affecting rock fragmentation, mechanism of rock breakage and fractures. Rock Fragmentation: Method of rock fragmentation - explosive action, cutting, ripping and impacts
	UNIT-II: Mechanics of rotary, percussive and rotary - percussive drilling, short and long hole drilling equipment, different types of bits, bit wear, drilling in difficult formations, drillbility of rocks, drilling performance and costs.	UNIT-II: Physio- Mechanical Properties of Rocks Application 'of compression, tensile and multi - axial strength, index test and abrasivity, anisotropy, elasticity, porosity, lamination, bedding joints in rock fragmentation process.
	UNIT-III: Mechanism of Rock breaking machines, pneumatic and Hydraulic rock hammers. Mechanics of rock fragmentation and fracture by explosive action, explosives.	UNIT-III: Principles of Rock Cutting Technology: Drilling and its various types i.e., rotary, percussive; rotary - percussive mechanism of rock percussion, theory of single tool rock cutting, crack initiation, propagation and breakage pattern. Drillability Drillability index, rock cutting picks, discs and rolls cutter. Water jet cutting, Jet piercing technique, determination of Drillability index
	UNIT-IV: Blasting accessories, blasting parameters, design of blasting rounds for opencast and underground mines, blastability of rocks, blasting efficiency, mean fragment size, misfires, blown out shots, incomplete detonation, their causes and remedial measures.	UNIT-IV: Equipments for Rock Excavation Excavation in surface mines- Shovel, Dragline and Bucket Wheel Excavators, Surface miner Excavation in underground mines- Continuous miners, Road headers, TBM, Coal face cutters, Loaders
	UNIT-V: Controlled blasting techniques, perimeter blasting, safety precautions, ground vibrations and air over pressure from blasting. Instrumentation for blast monitoring, Borehole pressure transducer, V.O.D Probe, vibration monitor, Impact of ground vibration and air overpressure	UNIT-V: Rock Cutting Tools Cutting tool material – types, relative application and their choice, tool shape and size, specific energy consumption, tool wear.

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	on the neighboring structures and communities, and mitigate measures. Case Studies.	

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Regulation	Pre-Revision	Post-Revision
Course Title	Mineral Processing Technology Lab	Mineral Processing Lab
Course Code	171MI6L05	191MI6L06
Syllabus	List of Experiments: 1. To determine and analyze the size distribution of a fixed granular solid by using a Test Sieve Stack. 2. To determine and analyze the size distribution of a fixed granular solid by using a Vibratory Shaker. 3. Determination of average size by sieving of a crushed ore sample in the Jaw Crusher. 4. To study the jaw crusher and determination the actual capacity. 5. Determine the reduction ratio of an ore sample in Jaw Crusher. 6. Verification of Rittinger's law of Crushing. 7. Determination of average size by sieving of crushed Ore sample in roller crusher. 8. To study the effect of grinding with grinding time in Ball mill. 9. To study the effect of grinding with frequency (RPM) in Ball mill. 10. Perform the beneficiation of an Ore pulp mix using Floatation Cell. 11. Study of magnetic separator, and effect of magnetic field on efficiency of the process. 12. Perform the Jigging operation to detecting the rate of stratification. List of Augmented Experiments: 1. Crushing of Coal in the Jaw Crusher, and Determination of average size by sieving. 2. Determine the theoretical capacity and actual capacity of a roller crusher. 3. Compare the reduction ratio of an ore sample and the coal sample. 4. Determine the reduction ratio of a coal sample in Jaw Crusher. 5. Determine the reduction ratio of a coal sample in Ball mill.	List of Experiments: 1.To do Sampling by Using Conning and quartering and John Riffle and calculation of error 2. Determination of various sized product by using different Sieve shaker 3. Determination of average size reduction by Jaw crusher and study their theoretical and actual capacity 4. Determination of average size by sieving of crushed Ore sample in roller crusher. 5. To study the effect of grinding with grinding time in Ball mill. 6. To study the effect of grinding with frequency (RPM) in Ball mill. 7. Determination of Washability Curve by using Float -sink analysis., 8. Determination of Proximate analysis of coal. 9. Perform the beneficiation of an Oxide ore pulp mix using Floatation Cell. 10. Perform the beneficiation of an sulphide ore pulp mix using Floatation cell 11. Study of magnetic separator, and effect of magnetic field on efficiency of the process. 12. Perform the Jigging operation to detecting the rate of stratification. List of Augmented Experiments: 1. Crushing of Coal in the Jaw Crusher, and Determination of average size by sieving. 2. Determine the theoretical capacity and actual capacity of a roller crusher. 3. Compare the reduction ratio of an ore sample and the coal sample. 4. Determine the reduction ratio of a coal sample in Jaw Crusher. 5. Determine the reduction ratio of a coal sample in Ball mill.

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Program Name : B.Tech. in Agricultural Engineering

Syllabus Revision for the Academic Year 2021-2022

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
1	I	201HS1T01	Communicative English	0
2	I	201BS1T01	Differential equations and Linear algebra	0
3	I	201BS1T02	Engineering Physics	0
4	I	201ES1T04	Principles of Agronomy and Soil Science	0
5	I	201ES1T05	Engineering Graphics	0
6	I	201HS1L01	Communicative English Lab	0
7	I	201BS1L01	Engineering Physics Lab	0
8	I	201ES1L04	Soil Science and Agronomy Field Lab	0
9	I	201MC1T01	Environmental Science	0
10	I	201BS2T05	Partial Differential Equations and Vector Calculus	0
11	II	201BS2T08	Chemistry of Materials	0
12	II	201ES2T06	Engineering Mechanics	0
13	II	201ES2T08	Programming for Problem Solving Using C	0
14	II	201ES2L07	Engineering Workshop	0
15	II	201ES2L12	Computer Aided Drafting Lab	0
16	II	201HS2L02	Professional communications skills Lab	0
17	II	201BS2L05	Engineering Chemistry Lab	0

18	II	201ES2L10	Programming for Problem Solving Using C	0
19	II	201MC2T02	Constitution of India	0
20	III	201BS3T12	Integral Transforms and Applications of Partial Differential Equations	0
21	III	201AG3T01	Surveying and Levelling	0
22	III	201AG3T02	Fluid Mechanics and Open Channel Hydraulics	0
23	III	201AG3T03	Thermodynamics, Refrigeration and Air Conditioning	30
24	III	201AG3T04	Strength of Materials	5
25	III	201AG3L01	Surveying and Levelling Lab	0
26	III	201AG3L02	Fluid Mechanics and Open Channel Hydraulics Lab	0
27	III	201AG3L03	Thermodynamics, Refrigeration and Air Conditioning Lab	100
28	III	201SO3L10	1) Computer Aided Manufacturing	100
29	III	201SO3L11	2) Computer Aided Design using SolidWorks	100
30	III	201MC3T03	Biology for Engineers	0
31	IV	201ES4T21	Soil Mechanics	100
32	IV	201BS4T15	Numerical Methods and Statistical Techniques	0
33	IV	201AG4T05	Heat and Mass Transfer	0
34	IV	201AG4T06	Tractor Systems and Controls	30
35	IV	201HS4T07	Entrepreneurship Development and Business Management	100
36	IV	201ES4L17	Soil Mechanics Lab	15
37	IV	201AG4L04	Tractor Systems and Controls Lab	30
38	IV	201AG4L05	Heat and Mass Transfer Lab	0
39	IV	201SC4L22	1) Food Quality and Control	100
40	IV	201SC4L23	2) Analysis/Simulation using MATLAB	100
41	IV	201MC4T04	Essence of Indian Traditional Knowledge	0

42	V	191AG5T09	Strength of Materials	0
43	V	191AG5T10	Theory and Design of Agricultural Machinery	30
44	V	191AG5T11	Agricultural Process Engineering and Food Quality	20
45	V	191AG5E01	Engineering Properties of Biological Materials	20
46	V	191AG5E02	Mechanical Measurement and Instrumentation	0
47	V	191AG5E03	Theory of Structures	0
48	V	191CE5O01	Basic Concrete Technology	100
49	V	191EE5O01	Electrical Safety	100
50	V	191EE5O02	Electrical Materials	100
51	V	191EE5O03	Basic Electrical Measurements	10
52	V	191ME5O02	Fundamentals of Mechanical Engineering	100
53	V	191ME5O03	Supply Chain Management	100
54	V	191ME5O04	3D Printing	100
55	V	191ME5O05	Entrepreneurship Development and Incubation	100
56	V	191EC5O01	Signals & Systems	100
57	V	191EC5O02	Digital Electronics and Logic Design	100
58	V	191EC5O03	Semi conductor devices	100
59	V	191CS5O01	Data Structures	100
60	V	191CS5O02	Object Oriented Programming through C++	100
61	V	191CS5O03	Java Programming	100
62	V	191CS5O04	R Programming	100
63	V	191IT5O01	Data Base Management Systems	100
64	V	191IT5O02	Computer Graphics	100
65	V	191MI5O01	Overview of Mining	100

66	V	191PT5O01	Process Intensification in Petroleum Industry	100
67	V	191PT5O02	Fundamentals of Petroleum Industry	100
68	V	191AG5L07	Soil Mechanics Lab	100
69	V	191AG5L08	Theory and Design of Agricultural Machine LAB	100
70	V	191AG5L09	Agricultural Process Engineering and Food Quality LAB	10
71	V	191HS5T06	Employability Skills - III	0
72	V	191PR5P02	Socially Relevant Project	100
73	V	191MC5A08	Intellectual Property Rights and Patents	0
74	VI	191AG6T12	Irrigation and Drainage Engineering	10
75	VI	191AG6T13	Post-Harvest Engineering for Horticultural Produce	5
76	VI	191AG6T14	Agricultural Machinery and Equipment	40
77	VI	191AG6E06	Human Engineering and Safety	10
78	VI	191AG6E04	Agricultural Structures	10
79	VI	191AG6E05	Agro Industries and By- Product Utilization	10
80	VI	191AG6E07	Design of Agricultural Machinery	30
81	VI	191AG6E09	Watershed Planning and Management	15
82	VI	191AG6E08	Seed Processing and Storage Engineering	15
83	VI	191CE6O02	Disaster Management	100
84	VI	191EE6O04	Energy Audit and Conservation Management	100
85	VI	191EE6O05	Non Conventional Energy resources	100
86	VI	191ME6O08	Introduction to Hydraulics and Pneumatics	100
87	VI	191ME6O09	3D Printing	100
88	VI	191ME6O06	Robotics	100
89	VI	191ME6O09	Management Science	100

90	VI	191ME6O07	Biomedical Instrumentation	100
91	VI	191ME6O08	ECAD Tools	100
92	VI	191CS6O05	Python Programming	100
93	VI	191CS6O06	Operating Systems	100
94	VI	191CS6O07	Web Technologies	100
95	VI	191CS6O08	Cyber Security	100
96	VI	191CS6O09	AR / VR	100
97	VI	191IT6O03	Computer Organization	100
98	VI	191IT6O04	AI Tools & Techniques	100
99	VI	191MI6O03	Electrical Equipment's in Mines	100
100	VI	191PT6O03	Unconventional Hydrocarbon Resources	100
101	VI	191PT6O04	Asset Management	100
102	VI	191ME6O12	Entrepreneurship Development and Incubation	100
103	VI	191AG6L10	Irrigation and Drainage Engineering LAB	100
104	VI	191AG6L11	Agricultural Machinery and Equipment Lab	30
105	VI	191HS6T07	Employability Skills – IV	0
106	VI	191MC6A09	Professional Ethics and Human Values	0
107	VII	171AG7T18	Micro Irrigation Engineering	0
108	VII	171AG7T19	Farm Machinery and Equipment – II	0
109	VII	171AG7T20	Dairy and Food Engineering	0
110	VII	171ES7T26	Mechanical Measurements and Instrumentation	0
111	VII	171AG7E09	Seed Processing and Storage Engineering	0
112	VII	171AG7E10	Food Processing Plant Design and Layout	0
113	VII	171AG7E11	Food Packaging Technology	0

114	VII	171AG7E12	Aqua Cultural Engineering	0
115	VII	171AG7E13	Soil Dynamics in Tillage and Traction	0
116	VII	171AG7E14	Computational Fluid Dynamics	0
117	VII	171AG7L06	Farm Machinery Lab – II	0
118	VII	171AG7L07	Dairy and Food Engineering Lab	0
119	VII	171AG7P01	Industry Oriented (Internship) Minor Project	0
120	VIII	171AG8E15	Hydraulic Devices and Control	0
121	VIII	171AG8E16	Watershed Management	0
122	VIII	171AG8E17	Design of Agricultural Machinery	0
123	VIII	171AG8O01	Digital Control systems	0
124	VIII	171AG8O02	Industrial Pollution Control Engineering	0
125	VIII	171AG8O03	Mechatronics	0
126	VIII	171AG8O04	Water Resources Systems Planning and Management	0
127	VIII	171CS8O04	Operations Research	0
128	VIII	171AG8O05	Image Processing Techniques	0
129	VIII	171AG8P02	Major Project	0
Total number of courses in the academic year 2021-2022				129
Number of courses having revision in syllabus content >/= 20% in the academic year 2021-2022				59
Percentage of syllabus revision carried out in the academic year 2021-2022 = (25/88)*100				45.73

Program Coordinator

N.V. God
Head of the Department

Head of the Department
Department of Agricultural Engineering
ADITYA ENGINEERING COLLEGE (A9)

PROGRAM STRUCTURE

I SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201HS1T01	Communicative English	HSMC	Theory	3	0	0	3	3
201BS1T01	Differential equations and Linear algebra	BSC	Theory	3	0	0	3	3
201BS1T02	Engineering Physics	BSC	Theory	3	0	0	3	3
201ES1T04	Principles of Agronomy and Soil Science	ESC	Theory	3	0	0	3	3
201ES1T05	Engineering Graphics	ESC	Theory	1	0	4	5	3
201HS1L01	Communicative English Lab	HSMC	Lab	0	0	3	3	.1.5
201BS1L01	Engineering Physics Lab	BSC	Lab	0	0	3	3	1.5
201ES1L04	Soil Science and Agronomy Field Lab	ESC	Lab	0	0	3	3	1.5
201MC1T01	Environmental Science	MC	Theory	2	0	0	2	0
			TOTAL	**15**	**0**	**13**	**28**	**19.5**

II SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS2T05	Partial Differential Equations and Vector Calculus	BSC	Theory	3	0	0	3	3
201BS2T08	Chemistry of Materials	BSC	Theory	3	0	0	3	3
201ES2T06	Engineering Mechanics	ESC	Theory	3	0	0	3	3
201ES2T08	Programming for Problem Solving Using C	ESC	Theory	3	0	0	3	3
201ES2L07	Engineering Workshop	ESC	Lab	0	0	3	3	1.5
201ES2L12	Computer Aided Drafting Lab	ESC	Lab	0	0	3	3	1.5
201HS2L02	Professional communications skills Lab	HSMC	Lab	0	0	3	3	1.5
201BS2L05	Engineering Chemistry Lab	BSC	Lab	0	0	3	3	1.5
201ES2L10	Programming for Problem Solving Using C Lab	ESC	Lab	0	0	3	3	1.5
201MC2T02	Constitution of India	MC	Theory	2	0	0	2	0
			TOTAL	**14**	**0**	**15**	**29**	**19.5**

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III SEMESTER

Course Code	Course Title	Course Component	Course Type	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201BS3T12	Integral Transforms and Applications of Partial Differential Equations	BSC	Theory	3	0	0	3	3
201AG3T01	Surveying and Levelling	PCC	Theory	3	0	0	3	3
201AG3T02	Fluid Mechanics and Open Channel Hydraulics	PCC	Theory	3	0	0	3	3
201AG3T03	Thermodynamics, Refrigeration and Air Conditioning	PCC	Theory	3	0	0	3	3
201AG3T04	Strength of Materials	PCC	Theory	3	0	0	3	3
201AG3L01	Surveying and Levelling Lab	PCC	Lab	0	0	3	3	1.5
201AG3L02	Fluid Mechanics and Open Channel Hydraulics Lab	PCC	Lab	0	0	3	3	1.5
201AG3L03	Thermodynamics, Refrigeration and Air Conditioning Lab	PCC	Lab	0	0	3	3	1.5
201SC3L11 201SC3L12	**Skill Oriented Course-I** 1. Computer Aided Manufacturing 2. Computer Aided Design Using Solid Works	SC	Lab	0	0	4	4	2
201MC3T03	Biology for Engineers	MC	Theory	2	0	0	2	0
			TOTAL	17	0	13	30	21.5

IV SEMESTER

Course Code	Course Title	Course Component	CourseType	Total Number of contact hours				Credits (C)
				Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
201ES4T21	Soil Mechanics	ESC	Theory	3	0	0	3	3
201BS4T15	Numerical Methods and Statistical Techniques	BSC	Theory	3	0	0	3	3
201AG4T05	Heat and Mass Transfer	PCC	Theory	3	0	0	3	3
201AG4T06	Tractor Systems and Controls	PCC	Theory	3	0	0	3	3
201HS4T07	Entrepreneurship Development and Business Management	HSMC	Theory	3	0	0	3	3
201ES4L17	Soil Mechanics Lab	ESC	Lab	0	0	3	3	1.5
201AG4L04	Tractor Systems and Controls Lab	PCC	Lab	0	0	3	3	1.5
201AG4L05	Heat and Mass Transfer Lab	PCC	Lab	0	0	3	3	1.5
201SC4L22 201SC4L23	**Skill Oriented Course-II** 1. Analysis/Simulation using MATLAB 2. Food Quality and Control	SC	Lab	0	0	4	4	2
201MC4T04	Essence of Indian Traditional Knowledge	MC	Theory	2	0	0	2	0
			Total	17	0	13	30	21.5

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BSC: Basic Sciences Courses; HSMC: Humanities and Social Sciences including Management Courses; ESC: Engineering Sciences Courses; PCC: Professional Core Courses; SC: Skill Oriented Course; PEC: Professional Elective Courses; OEC: Open Elective Courses; MC: Mandatory Courses; PROJ: Project.

HONORS PROGRAM

Specialization: Soil and Water Engineering

S.No.	Course Code	COURSE TITLE	L	T	P	C	SEMESTER
1.	201AG4H01	Water Quality and Management Measures	3	1	0	4	IV
2.	201AG5H04	Sprinkler and Micro Irrigation Systems	3	1	0	4	V
3.	201AG6H07	Management of Canal Irrigation System	3	1	0	4	VI
4.	201AG7H10	Remote Sensing and GIS Applications	3	1	0	4	VII

Specialization: Farm Machinery and Power Engineering

S.No.	Course Code	COURSE TITLE	L	T	P	C	SEMESTER
1.	201AG4H02	Machine Design	3	1	0	4	IV
2.	201AG5H05	Farm Machinery Design and Production	3	1	0	4	V
3.	201AG6H08	Mechanics of Tillage and Traction	3	1	0	4	VI
4.	201AG7H11	Tractor and Farm Machinery Operation and Maintenance	3	1	0	4	VII

Specialization: Processing and Food Engineering

S.No.	Course Code	COURSE TITLE	L	T	P	C	SEMESTER
1.	201AG4H03	Food Plant Design and Management	3	1	0	4	IV
2.	201AG5H06	Post Harvest Engineering of Horticultural Crops	3	1	0	4	V
3.	201AG6H09	Dairy and Food Engineering	3	1	0	4	VI
4.	201AG7H12	Waste and By-products Utilization	3	1	0	4	VII

MINOR PROGRAM

S.No.	Course Code	COURSE TITLE	L	T	P	C	SEMESTER
1.	201AG4M01	Groundwater, Wells and Pumps	3	1	0	4	IV
2.	201AG4M02	Tractor and Automotive Engines	3	1	0	4	IV
3.	201AG4M03	Engineering Properties of Agricultural Produce	3	1	0	4	IV
4.	201AG5M04	Irrigation Engineering	3	1	0	4	V
5.	201AG5M05	Tractor Systems and Controls	3	1	0	4	V
6.	201AG5M06	Post Harvest Engineering of Cereals, Pulses and Oil	3	1	0	4	V

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		Seeds					
7.	201AG6M07	Drainage Engineering	3	1	0	4	VI
8.	201AG6M08	Farm Machinery and Equipment-I	3	1	0	4	VI
9.	201AG6M09	Post Harvest Engineering of Horticultural Crops	3	1	0	4	VI
10.	201AG7M10	Sprinkler and Micro Irrigation Systems	3	1	0	4	VII
11.	201AG7M11	Farm Machinery and Equipment-II	3	1	0	4	VII
12.	201AG7M12	Food Packaging Technology	3	1	0	4	VII

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V SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
191AG5T09	Strength of Materials	PCC	2	1	0	3	3
191AG5T10	Theory and Design of Agricultural Machinery	PCC	2	1	0	3	3
191AG5T11	Agricultural Process Engineering and Food Quality	PCC	2	1	0	3	3
----	**Professional Elective -I**	**PEC**	2	1	0	3	3
----	**Open Elective-I**	**OEC**	2	1	0	3	3
191AG5L07	Soil Mechanics Lab	PCC	0	0	2	2	1
191AG5L08	Theory and Design of Agricultural Machinery LAB	PCC	0	0	2	2	1
191AG5L09	Agricultural Process Engineering and Food Quality LAB	PCC	0	0	3	3	1.5
191HS5T06	Employability Skills - III	HSS	0	0	0	0	1
191PR5P02	Socially Relevant Project	PROJ	0	0	0	0	1
	Intellectual Property Rights and Patents	HSS					
		TOTAL	**10**	**5**	**7**	**22**	**20.5**

VI SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
191AG6T12	Irrigation and Drainage Engineering	PCC	2	1	0	3	3
191AG6T13	Post-Harvest Engineering for Horticultural Produce	PCC	3	0	0	3	3
191AG6T14	Agricultural Machinery and Equipment	PCC	2	1	0	3	3
----	**Professional Elective -II**	**PEC**	2	1	0	3	3
----	**Professional Elective -III**	**PEC**	2	1	0	3	3
----	**Open Elective-II**	**OEC**	2	1	0	3	3
191AG6L10	Irrigation and Drainage Engineering LAB	PCC	0	0	2	2	1
191AG6L11	Agricultural Machinery and Equipment Lab	PCC	0	0	3	3	1.5
191HS6T07	Employability Skills – IV	HSS	0	0	0	0	1
	Professional Ethics and Human Values	HSS					
		TOTAL	**13**	**5**	**4**	**22**	**21.5**

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VII SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
191AG7T15	Dairy and Food Engineering	PCC	2	1	0	3	3
191AG7T16	Soil and Water Conservation Engineering	PCC	2	1	0	3	3
----	**Professional Elective -IV**	**PEC**	2	1	0	3	3
----	**Professional Elective -V**	**PEC**	2	1	0	3	3
----	**Open Elective-III**	**OEC**	2	1	0	3	3
191AG7P03	Internship	PRC	0	0	0	0	2
191AG7L12	Dairy and Food Engineering Lab	PCC	0	0	2	2	1
191AG7L13	Soil and Water Conservation Engineering LAB	PCC	0	0	2	2	1
191AG7P04	Project Part 1	PROJ	0	0	4	4	2
		TOTAL	**10**	**5**	**8**	**23**	**21**

VIII SEMESTER

Course Code	Name of the Course	Course Component	Periods/Week				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
----	**Professional Elective -VI**	**PEC**	2	1	0	3	3
----	**Open Elective-IV**	**OEC**	2	1	0	3	3
191AG8P05	Project Part 2	PROJ	0	0	14	14	7
		TOTAL	**4**	**2**	**14**	**20**	**13**

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Sl. No.	Track Title/ Sub Specialization	Professional Elective I	Professional Elective II	Professional Elective III	Professional Elective IV	Professional Elective V	Professional Elective VI
1	**Farm Machinery Engineering**	Mechanical Measurement and Instrumentation 191AG5E02	Human Engineering and Safety 191AG6E06	Design of Agricultural Machinery 191AG6E07	Soil Dynamics in Tillage and Traction 191AG7E11	Production Technology in Agricultural Machinery 191AG7E15	Hydraulic Devices and Control 191AG8E16
2	**Soil Water and Conservation Engineering**	Theory of Structures 191AG5E03	Agricultural Structures 191AG6E04	Watershed Planning and Management 191AG6E09	Water Quality and Pollution Control 191AG7E12	Microirrigation Engineering 191AG7E14	Introduction to Remote Sensing and GIS 191AG8E17
3	**Agricultural Process and Food Engineering**	Engineering Properties of Biological Material 191AG5E01	Agro Industries and By-Product Utilization 191AG6E05	Seed Processing and Storage Engineering 191AG6E08	Food Packaing Technology 191AG7E10	Food Processing Plant Design and Layout 191AG7E13	Novel Technologies for Food Processing and Shelf Life Extension 191AG8E18

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Open Elective - I (V Semester)

S. No	Course Code	Course Name	Not Offered to Branches	Offered By Department
1	191CE5O01	Basic Concrete Technology	CE, EEE	CE
2	191EE5O01	Electrical Safety	EEE	EEE
3	191EE5O02	Electrical Materials	EEE	EEE
4	191EE5O03	Basic Electrical Measurements	EEE, ECE	EEE
5	191ME5O01	Renewable Energy Sources	CE, EEE, ME, Ag. E	ME
6	191ME5O02	Fundamentals of Mechanical Engineering	ME	ME
7	191ME5O03	Supply Chain Management	ME	ME
8	191ME5O04	3D Printing	ME	ME
9	191ME5O05	Entrepreneurship Development and Incubation		ME
10	191EC5O01	Signals & Systems	EEE, ECE	ECE
11	191EC5O02	Digital Electronics and Logic Design	EEE, ECE, CSE, IT	ECE
12	191EC5O03	Semi conductor devices	EEE, ECE	ECE
13	191CS5O01	Data Structures	EEE, ECE, CSE, IT	CSE
14	191CS5O02	Object Oriented Programming through C++	CSE, IT	CSE
15	191CS5O03	Java Programming	CSE, IT	CSE
16	191CS5O04	R Programming		CSE
17	191IT5O01	Data Base Management Systems	CSE, IT	IT
18	191IT5O02	Computer Graphics	CSE, IT	IT
19	191MI5O01	Overview of Mining	Min.E	Min.E
20	191PT5O01	Process Intensification in Petroleum Industry	PT	PT
21	191PT5O02	Fundamentals of Petroleum Industry	PT	PT
22	191AG5O01	Basic Crop Production Practices	Ag.E	Ag.E

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Open Elective - II (VI Semester)

S. No	Course Code	Course Name	Not Offered to Branches	Offered By Department
1	191CE6O02	Disaster Management		CE
2	191EE6O04	Energy Audit and Conservation Management	EEE	EEE
3	191EE6O05	Non Conventional Energy resources	EEE	EEE
4	191EE6O06	Instrumentation	EEE, ECE, Ag. E	EEE
5	191ME6O06	Solar Energy Utilisation	ME, Ag. E	ME
6	191ME6O07	Basic Thermodynamics and Heat Transfer	EEE, ME, PT, Ag.E, Min.E	ME
7	191ME6O08	Introduction to Hydraulics and Pneumatics	CE, ME, PT	ME
8	191ME6O09	3D Printing	ME	ME
9	191ME6O06	Robotics	ME	ME
10	191ME6O11	Management Science	CE, CSE, IT, PT, Min. E	ME
11	191ME6O07	Biomedical Instrumentation		ECE
12	191ME6O08	ECAD Tools	ECE	ECE
13	191CS6O05	Python Programming	EEE, CSE, IT	CSE
14	191CS6O06	Operating Systems	CSE, IT	CSE
15	191CS6O07	Web Technologies	CSE, IT	CSE
16	191CS6O08	Cyber Security	CSE, IT	CSE
17	191CS6O09	AR / VR		CSE
18	191IT6O03	Computer Organization	CSE, IT	IT
19	191IT6O04	AI Tools & Techniques	CSE, IT	IT
20	191IT6O05	Robotic Process Automation		IT
21	191MI6O02	Industrial Safety Practices	Ag.E	Min.E
22	191MI6O03	Electrical Equipment's in Mines		Min.E
23	191PT6O03	Unconventional Hydrocarbon Resources	PT	PT
24	191PT6O04	Asset Management		PT
25	191AG6O02	Weather Forecast in Agriculture		Ag.E
26	191AG6O03	Bio-Energy Systems Design and Applications		Ag.E
27	191ME6O12	Entrepreneurship Development and Incubation		ME

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V SEMESTER

Course Code	Name of the Course	Category	Total number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total hours	
171AG5T09	Theory of Structures	PC	3	1	---	4	3
171AG5T10	Irrigation and Drainage Engineering	PC	3	1	---	4	3
171AG5T11	Agricultural Process Engineering	PC	3	1	---	4	3
171AG5T12	Agricultural Extension Techniques and Business Management	PC	3	1	---	4	3
171AG5T13	Farm Power and Tractor Systems	PC	3	1	---	4	3
---	**Professional Elective – I**	PE	3	1	---	4	3
171HS5T06	Employability Skills - III	HSS	2	---	---	2	1
171AG5L02	Agricultural Process Engineering Lab	PC	---	---	3	3	2
171AG5L03	Field Operation and Maintenance of Tractors Lab	PC	---	---	3	3	2
171AG5S01	MOOCs – I	SS	---	---	---	---	---
		TOTAL	**20**	**6**	**6**	**32**	**23**

VI SEMESTER

Course Code	Name of the Course	Category	Total number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total hours	
171AG6T14	Soil and Water Conservation Engineering	PC	3	1	---	4	3
171AG6T15	Farm Machinery and Equipment – I	PC	3	1	---	4	3
171AG6T16	Design of Soil, Water Conservation and Farm Structures	PC	3	1	---	4	3
171AG6T17	Post Harvest Engineering for Horticulture Produce	PC	3	1	---	4	3
---	**Professional Elective - II**	PE	3	1	---	4	3
---	**Professional Elective - III**	PE	3	1	---	4	3
171HS6T07	Employability Skills - IV	HSS	2	---	---	2	1
171AG6L04	Farm Machinery Lab - I	PC	---	---	3	3	2
171AG6L05	Soil and Water Engineering Lab	PC	---	---	3	3	2
171AG6S02	MOOCs - II	SS	---	---	---	---	---
		TOTAL	**20**	**6**	**6**	**32**	**23**

MOOCs – Massive Open Online Courses

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VII SEMESTER

Course Code	Name of the Course	Category	Total number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total hours	
171AG7T18	Micro Irrigation Engineering	PC	3	1	---	4	3
171AG7T19	Farm Machinery and Equipment – II	PC	3	1	---	4	3
171AG7T20	Dairy and Food Engineering	PC	3	1	---	4	3
171ES7T26	Mechanical Measurements and Instrumentation	ES	3	1	---	4	3
---	**Professional Elective – IV**	PE	3	1	---	4	3
---	**Professional Elective – V**	PE	3	1	---	4	3
171AG7L06	Farm Machinery Lab – II	PC	---	---	3	3	2
171AG7L07	Dairy and Food Engineering Lab	PC	---	---	3	3	2
171AG7P01	Industry Oriented (Internship) Minor Project	PR	---	---	---	---	1
		TOTAL	**18**	**6**	**6**	**30**	**23**

VIII SEMESTER

Course Code	Name of the Course	Category	Total number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total hours	
---	**Professional Elective - VI**	PE	3	1	---	4	3
---	**Open Elective**	OE	3	1	---	4	3
171AG8P02	**Major Project**	PR	---	---	---	---	14
		TOTAL	**6**	**2**	**0**	**8**	**20**

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Professional Elective – I (V Semester)

S.No	Course Code	Name of the Course
1	171AG5E01	Agro Industries and Bi-Product Utilization
2	171HS5E01	Managerial Economics and Financial Analysis
3	171AG5E02	Rural Water Supply, Sanitation and Environmental Engineering

Professional Elective – II (VI Semester)

S.No	Course Code	Name of the Course
1	171AG6E03	GIS and Remote Sensing
2	171AG6E04	Human Engineering and Safety
3	171AG6E05	Production Technology of Agricultural Machinery

Professional Elective – III (VI Semester)

S.No	Course Code	Name of the Course
1	171AG6E06	Green House / Poly House Technology
2	171AG6E07	Optimization, Operations Research and Systems Engineering
3	171AG6E08	Industrial Engineering and Management

Professional Elective – IV (VII Semester)

S.No	Course Code	Name of the Course
1	171AG7E09	Seed Processing and Storage Engineering
2	171AG7E10	Food Processing Plant Design and Layout
3	171AG7E11	Food Packaging Technology

Professional Elective – V (VII Semester)

S.No	Course Code	Name of the Course
1	171AG7E12	Aqua Cultural Engineering
2	171AG7E13	Soil Dynamics in Tillage and Traction
3	171AG7E14	Computational Fluid Dynamics

Professional Elective – VI (VIII Semester)

S.No	Course Code	Name of the Course
1	171AG8E15	Hydraulic Devices and Control
2	171AG8E16	Watershed Management
3	171AG8E17	Design of Agricultural Machinery

Open Elective (VIII Semester)

S.No	CourseCode	Name of the Course
1	171AG8O01	Digital Control systems
2	171AG8O02	Industrial Pollution Control Engineering
3	171AG8O03	Mechatronics
4	171AG8O04	Water Resources Systems Planning and Management
5	171CS8O04	Operations Research
6	171AG8O05	Image Processing Techniques

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Course Component	Curriculum content (% of total number of credits of the program)	Total number of contact hours	Total number of credits
Basic Sciences	10.55	30	19
Engineering Sciences	20.55	49	37
Humanities and social sciences	7.77	29	14
Program core	41.11	101	74
Program Elective	10.00	24	18
Open Elective	1.6	4	3
Project	7.7	-	14
Internship/Seminar	0.5	-	1
Any other (Please Specify)		-	-
TOTAL	100	237	180

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THERMODYNAMICS, REFRIGERATION AND AIR CONDITIONING

(Ag.E)

III Semester **L T P C**
Course Code: 201AG3T03 **3 0 0 3**

Course Objectives:

COB 1: To introduce the students with a simplistic and practical approach to the fundamental concepts of thermodynamics.
COB 2: To create an interest and intuitive understanding of the nuances of this core subject which deals with energy and its different forms.
COB 3: To impart Knowledge on working principle of various refrigeration systems.

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1: Explain the basic concepts and laws of thermodynamics.
CO 2: Explain the working principle and performance of air cycles and steam properties.
CO 3: Explain the various refrigeration cycles, their applications, analyze their performance.
CO 4: Distinguish working principles of various refrigeration systems.
CO 5: Explain various Psychometric process and principle involved in air conditioning system.

Mapping of course outcomes with program outcomes:

CO/PO	PO 1 (K3)	PO 2 (K4)	PO 3 (K5)	PO 4 (K5)	PO 5 (K3)	PO 6 (K3)	PO 7 (K2)	PO 8 (K3)	PO 9 (K2)	PO 10 (K2)	PO11 (K3)	PO12 (K1)
CO1 (K2)	2	1	2	-	-	-	3	-	-	3	2	-
CO2 (K2)	2	1	2	-	-	-	3	-	-	3	2	-
CO3 (K2)	2	1	2	-	-	-	3	-	-	3	2	-
CO4 (K4)	2	3	2	-	-	-	1	-	-	1	2	-
CO5 (K2)	2	1	2	2	1	-	3	-	-	3	2	-

Mapping of course outcomes with program Specific Outcomes:

CO / PSO	PSO 1 (K3)	PSO 2 (K3)	PSO 3 (K4)
CO1 (K2)	2	-	1
CO2 (K2)	2	-	1
CO3 (K2)	2	-	1
CO4 (K4)	2	-	3
CO5 (K2)	2	-	1

UNIT-I:
Introduction:
Basic concepts of thermodynamics: Thermodynamic System & Its Properties; Closed system-open system-isolated system, Gas laws- Boyles' law, Charles Law, Gay Lussac's Law, Laws of ideal gases- compression and expansion of gases; Laws of thermodynamic – First Law of Thermodynamics & Non Flow Processes- Non-Flow and Flow Processes, Second law of thermodynamics- Second Law, Entropy, Carnot Cycle, Entropy and Availability, General expression for Change in Entropy.

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UNIT-II:

Engines: Classification, Components, working principles- Working cycle of 4-stoke and 2-stroke diesel and Petrol Engines, Comparison between 4 stroke and 2-stroke Diesel andPetrol Engines.

Power Cycle: Otto, Diesel, Dual Combustion cycles – Description and representation on P–V and T-S Diagram, Air standard cycle efficiencies, Thermal Efficiency Heat engines, mean effective pressure, Measurement of indicated horse power, brake horse power, Heat balance calculations, Problems on IP, BP, Engine efficiencies and performances.

UNIT-III:

Principles of Refrigeration: Units, Terminology; Refrigerating machine-the second law interpretation, heat engine vs heat pump vs refrigerating machine,.Energy ratios or Coefficient of performance, Power consumption of a refrigerating machine, Refrigeration cycles- The Carnot principle, Reversed Carnot cycle and Bell Coleman cycle, Vapour & Gas as refrigerant in reversed Carnot cycle, Numerical problems; Production low temperatures- Expansion of a liquid with flashing, reversible adiabatic expansion of a gas, irreversible adiabatic expansion (throttling) of a real gas, thermoelectric cooling, adiabatic demagnetization.

UNIT-IV:

Vapour Compression Systems: Modifications in reverse Carnot cycle with vapor as refrigerant (dry vs. wet compression, throttling vs isentropic expansion), Vapor compression cycle and component, vapor compression system calculations, P-h diagram - enthalpy diagram, super heating, sub cooling, effect of suction vapor super heating, sub cooling, problems on vapor compression cycle, Liquid-vapor regenerative heat exchanger for vapor compression system.

Vapor-Absorption Refrigeration System: Working principle, component, Maximum coefficient of performance of a heat operated refrigerating machine; common refrigerant- absorbent systems. Common refrigerants and their properties- Definition of refrigerant, Classification of refrigerants, Designations of refrigerants, Properties of refrigerants, Selection of refrigerants, Thermodynamic requirements, Chemical requirements, Physical requirements.

UNIT-V:

Psychrometry: Psychrometric Properties- Dry air, moist air, water vapour, wet bulb temperature, Dry bulb temperature, dew point temperature, specific humidity, absolute humidity, degree of saturation, Relative humidity, Sensible heat of air, Total heat of air, Humid specific volume, thermodynamic wet bulb temperature or temperature of adiabatic saturation process, psychometric chart and its use.

Air conditioning– principles –Type and functions of air conditioning, Basic processes in conditioning of air, Psychrometric processes in Air- conditioning equipment; Simple Air-conditioning system and state & mass rate of supply air; Summer air conditioning, Winter air conditioning; Fundamentals of design of air conditioning systems-humidifiers and dehumidifiers – cooling load calculations, types of air conditioners – applications.

Text Books:

1. Engineering Thermodynamics, Nag PK, Mc Graw Hill Publishing, 6th edition, 2017.
2. Refrigeration and Air conditioning, C P Arora, McGraw Hill Education, 3rd edition, 2017.
3. Thermal Engineering, R. Rudramoorthy, McGraw Hill Education, 2017.

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Reference Books:

1. Engineering Thermodynamics, Cengel & Boles, TMH publications.
2. Thermal Engineering, R.K.Rajput S.Chand & Co.

Web Links:

1. http://nptel.ac.in/courses/112108148/
2. http://nptel.ac.in/courses/112105123/
3. http://nptel.ac.in/courses/112104113/
4. http://highered.mheducation.com/sites/007352932x/student_view0/index.html
5. http://physics-animations.com/Physics/English/thermo.htm
6. http://ecoursesonline.iasri.res.in/course/view.php?id=62

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TRACTOR SYSTEMS AND CONTROLS

IV Semester | | L | T | P | C
Course Code: 201AG4T06 | | **3** | **0** | **0** | **3**

Course Objectives:

COB 1: To impart the knowledge on different types of tractors and engines.

COB 2: To make the students to know about carburetor, governor and lubricants.

COB 3: To enrich and familiarize the students in transmission system, clutch, gear box and differential unit.

COB 4: To understand about hydraulic system, traction and tractor mechanics.

Course Outcomes:

At the end of the Course, Student will be able to:

CO 1: Explain about various types of energy sources of farm power and types of IC engines.

CO 2: Explain and understand the working process, construction details of different components of engines and transmission system.

CO 3: Understand about hydraulic system and its functional requirements.

CO 4: Know about tractor mechanics and traction.

Mapping of Course Outcomes with Program Outcomes:

CO/ PO	PO 1 (K3)	PO 2 (K4)	PO 3 (K5)	PO 4 (K5)	PO 5 (K3)	PO 6 (K3)	PO 7 (K2)	PO 8 (K3)	PO 9 (K2)	PO 10 (K2)	PO 11 (K3)	PO 12 (K1)
CO1 (K2)	1	-	-	-	-	2	3	-	-	-	-	-
CO2 (K6)	2	-	2	-	-	-	2	-	-	-	2	-
CO3 (K2)	-	1	-	-	-	-	3	-	-	-	2	-
CO4 (K3)	-	-	-	-	-	-	2	-	-	-	3	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO / PSO	PSO 1 (K3)	PSO 2 (K3)	PSO 3 (K4)
CO1 (K2)	2	2	-
CO2 (K6)	2	2	-
CO3 (K2)	2	2	-
CO4 (K3)	3	3	-

UNIT I:

Study of sources of farm power –conventional & non-conventional energy sources. Classification of tractors and IC engines. Review of thermodynamic principles of IC (CI & SI) engines and deviation from ideal cycle. General energy equation and heat balance sheet. Study of mechanical, thermal and volumetric efficiencies. Study of engine components their construction, operating principles and functions. Study of engine strokes and comparison of 2-stroke and 4-stroke engine cycles and CI and SI engines. Study of Engine Valve systems, valve mechanism, Valve timing diagram, and valve clearance adjustment Study of Cam profile, valve lift and valve opening area. Study of importance of air cleaning system. Study of types of air cleaners and performance characteristics of various air cleaners. Study of fuel supply system. Study of fuels, properties of fuels, calculation of air-fuel ratio. Study of tests on fuel for SI and CI

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engines. Study of detonation and knocking in IC engines.

UNIT II:

Study of carburetion system, carburetors and their main functional components. Study of fuel injection system – Injection pump, their types, working principles. Fuel injector nozzles – their types and working principle. Engine governing – need of governors, governor types and governor characteristics. Study of lubrication system –need, types, functional components. Study of lubricants – physical properties, additives and their application. Engine cooling system – need, cooling methods and main functional components. Study of need and type of thermostat valves. Additives in the coolant. Study of radiator efficiency. Study of ignition system of SI engines. Study of electrical system including battery, starting motor, battery charging, cut-out, etc. Comparison of dynamo and alternator. Familiarization with the basics of engine testing.

UNIT III:

Study of need for transmission system in a tractor. Transmission system – types, major functional systems. Study of clutch – need, types, functional requirements, construction and principle of operation. Familiarization with single plate, multi-plate, centrifugal and dual clutch systems. Study of Gear Box – Gearing theory, principle of operation, gear box types, functional requirements, and calculation for speed ratio. Study of differential system – need, functional components, construction, calculation for speed reduction. Study of need for a final drive. Study of Brake system – types, principle of operation, construction, calculation for braking torque. Study of steering system – requirements, steering geometry characteristics, functional components, calculation for turning radius. Familiarization with Ackerman steering. Steering systems in track type tractors.

UNIT IV:

Study of Hydraulic system in a tractor – Principle of operation, types, main functional components, functional requirements. Familiarization with the Hydraulic system adjustments and ADDC. Study of tractor power outlets – PTO. PTO standards, types and functional requirements. Introduction to traction. Traction terminology. Theoretical calculation of shear force and rolling resistance on traction device. Study of wheels and tyres – Solid tyres and pneumatic tyres, tyre construction and tyre specifications. Study of traction aids.

UNIT V:

Study of tractor mechanics – forces acting on the tractor. Determination of CG of a tractor. Determination and importance of moment of inertia of a tractor. Study of tractor static equilibrium, tractor stability especially at turns. Determination of maximum drawbar pull. Familiarization with tractor as a spring-mass system. Ergonomic considerations and operational safety. Introduction to tractor testing. Deciphering the engine test codes.

Text Books

1. Tractors and Their Power Units, Liljedahl J B and Others.
2. Tractors and Automobiles, Rodichev V and G Rodicheva.
3. Automobile Engineering – Vol I, Singh Kirpal.
4. A course in Internal Combustion Engines, Mathur ML and RP Sharma.
5. Principles of Agricultural Engineering Vol I, Ojha, T.P. and Michael, A.M. 10th Edition. Jain Brothers, New Delhi, 2018.
6. Elements of Agricultural Engineering, Jagdishwar Sahay. Standard Publishers and Distributors Pvt Ltd, 2020.
7. Farm Machines and Equipment, Nakra, C.P. Dhanput Rai Publishing Company

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Pvt. Ltd., New Delhi, 2016.

Reference Books

1. Automotive Mechanics: Principles and Practices, Heitner Joseph.
2. Agricultural Engineering Handbook, C.B.Richey.
3. Fundamentals of Service Hydraulics, John Deere.
4. Relevant BIS Test Codes for Tractors.
5. Automotive Mechanics: Principles and Practices, Heitner Joseph.

Web Links:

1. http://ecoursesonline.iasri.res.in/course/view.php?id=19
2. http://ecoursesonline.iasri.res.in/course/view.php?id=39
3. https://www.unaab.edu.ng/opencourseware/Farm%20Power%20II.pdf
4. http://www.academia.edu/3848891/Farm_Tractor_Systems
5. https://www.researchgate.net/275642331-farm-tractor-systems
6. https://www.osha.gov.grant_materials.pdf
7. http://www.hillagric.ac.in/edu/coa/agengg/lecture/243/agriengg-243.html.

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TRACTOR SYSTEMS AND CONTROLS LAB

IV Semester		**L**	**T**	**P**	**C**
Course Code:	201AG4L04	**0**	**0**	**3**	**1.5**

Course Objectives:

COB 1: To make the students familiarize with different IC engines, parts and working principles.
COB 2: To enable the students learn about transmission system, components and its principles.
COB 3: To understand about hydraulic system of tractor and its design.
COB 4: To enable the students to know about properties of oil and traction.

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1: Understand about different types of engines and its process, functions of its components.
CO 2: Identify the different components of tractor and understand its functions.
CO 3: Design of gear box, clutch and brake system and determine center of gravity of tractor.
CO 4: Understand various controls of tractor and traction.

Mapping of course outcomes with Program Outcomes:

CO/ PO	PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K3)	PO6 (K3)	PO7 (K2)	PO8 (K3)	PO9 (K2)	PO10 (K2)	PO11 (K3)	PO12 (K1)
CO1 (K2)	2	-	-	-	-	-	3	-	-	-	2	-
CO2 (K4)	2	3	-	3	-	-	1	-	-	-	2	-
CO3 (K6)	2	1	2	-	-	-	2	-	-	-	2	-
CO4 (K2)	2	-	-	-	-	-	3	-	-	-	2	-

Mapping of course outcomes with Program Specific Outcomes:

CO / PSO	PSO1 (K3)	PSO 2 (K3)	PSO3 (K4)
CO1 (K2)	2	2	-
CO2 (K4)	2	2	-
CO3 (K6)	1	1	-
CO4 (K2)	2	1	-

List of experiments

1. Introduction to different systems of CI engines; Engine parts and functions, working principles etc.
2. Study, construction and adjustments of Valve system.
3. Study of air cleaning system and fuel supply system of SI engine.
4. Study of Lubricating system and its adjustments.
5. Introduction to transmission systems and components.
6. Study of clutch functioning, parts and design problem on clutch system.
7. Study of different types of gear box, calculation of speed ratios, design problems on gear box.
8. Study on differential and final drive and planetary gears.
9. Study of brake systems and some design problems.
10. Study of hydraulic systems in a tractor, hydraulic trainer and some design problems.
11. Determination of location of CG of a tractor, Moment of Inertia of a tractor.

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12. Visit to engine manufacturer/ assembler/ spare parts agency.

List of Augmented Experiments

(Any two of the following experiments can be performed)

13. Determination of physical properties of Oil & Fuel.
14. Tractor engine heat balance and engine performance curves.
15. Appraisal of various controls in different makes tractors in relation to anthropometric measurements.
16. Determination of traction performance of a traction wheel.

Text Books:

1. Tractors and Their Power Units, Liljedahl J B and Others.
2. Tractors and Automobiles, Rodichev V and G Rodicheva.
3. Automobile Engineering – Vol I, Singh Kirpal.
4. A course in Internal Combustion Engines. Mathur ML and RP Sharma.
5. Principles of Agricultural Engineering, Vol I. Ojha, T.P. and Michael, A.M. 10th Edition. Jain Brothers, New Delhi, 2018.
6. Elements of Agricultural Engineering, Jagdishwar Sahay. Standard Publishers and Distributors Pvt Ltd, 2020.
7. Farm Machines and Equipment, Nakra, C.P. Dhanput Rai Publishing Company Pvt. Ltd., New Delhi, 2016.

Reference Books:

1. Automotive Mechanics: Principles and Practices, Heitner Joseph.
2. Agricultural Engineering Handbook, C.B.Richey,
3. Fundamentals of Service Hydraulics, John Deere,
4. Relevant BIS Test Codes for Tractors.
5. Automotive Mechanics: Principles and Practices, Heitner Joseph.

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THEORY AND DESIGN OF AGRICULTURAL MACHINE

V Semester **L T P C**
Course Code: 191AG5T10 **2 1 0 3**

Course Objectives:

COB 1: To impart the knowledge on the role of kinematics of machinery, the mechanisms and machines.

COB 2: To make the students calculate the parameters of mechanical power transmission systems.

COB 3: To impart the knowledge on designing a shaft, key and coupling.

Course Outcomes:

At the end of the Course, Student will be able to:

CO 1 : Determine the velocity and acceleration for different mechanisms by graphical and analytical methods.

CO 2 : Determine the parameters of gears and geartrains.

CO 3 : Compute the parameters of mechanical components for power transmission.

CO 4 : Apply principles of design to mechanical power transmission elements such as shafts, keys & couplings, bearings.

CO 5 : Understand the concept of spring, cams and followers.

Mapping of course outcomes with program outcomes:

CO/PO	PO 1 (K3)	PO 2 (K4)	PO 3 (K5)	PO 4 (K5)	PO 5 (K3)	PO 6 (K3)	PO 7 (K2)	PO 8 (K3)	PO 9 (K2)	PO 10 (K2)	PO11 (K3)	PO12 (K1)
CO1 (K3)	3	2	1	-	-	-	-	-	-	-	-	-
CO2 (K3)	3	2	1	-	-	-	-	-	-	-	-	-
CO3 (K3)	3	2	-	-	-	-	-	-	-	-	-	-
CO4 (K3)	3	2	-	-	-	-	-	-	-	-	-	-
CO5 (K2)	2	1	1	1	-	-	-	-	-	-	-	-

Mapping of course outcomes with program Specific Outcomes:

CO / PSO	PSO 1 (K3)	PSO 2 (K3)	PSO 3 (K4)
CO1 (K3)	3	3	2
CO2 (K3)	3	3	2
CO3 (K3)	3	-	2
CO4 (K3)	3	-	2
CO5 (K2)	-	3	2

UNIT-I:

Introduction, Element, Link, Pairs. Kinematic pairs- Types, lower and higher pairs. Mechanism, machine and structure. Kinematics chains- Four bar chain, slider crank chain and their inversions.

Belt, Rope and Chain Drives: types of belt, rope and chain drives. Belt materials, Length of belt, Power transmitted, Velocity ratio, Belt size for flat and v-belts. Effect of centrifugal tension, creep and slip on power transmission. Problems on belt, rope and chain drives.

UNIT-II:

Gears: Types of gears, Law of gearing. Velocity of sliding between two teeth in mesh Involute and cycloidal profile for gear teeth. Spur gear, nomenclature, interference and undercutting. Introduction to helical, spiral, bevel and worm gear.

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Gear Trains: Simple, compound, reverted and epicyclical gear trains - Determining the velocity ratio by tabular method.

UNIT-III:

Flywheel: Turning moment Diagrams, Coefficient of fluctuation of speed and energy. Weight of fly wheel, flywheel applications.
Clutch: Types of friction, Laws of dry fiction, Friction of pivots and collars. Single disc, Multiple disc and cone clutches.

UNIT-IV:

Shafts: Material used for shafts, types and sizes of shafts. Design of shafts- basics, axial, bending, twisting, combined bending and twisting, buckling and fluctuating loads.
Keys and couplings: Introduction, types of keys-sunk key, saddle key, tangent key, round key and splines. Forces acting on sunk key. Effect of keyways. Shaft couplings–definition and types, design of flange coupling, muffle coupling, Hooke's coupling.

UNIT-V:

Springs: Introduction, terminology, types of springs, material for helical springs, springs in series and parallel, flat spiral springs, leaf springs, construction of leaf springs.
Balancing of Masses: Static and dynamic balancing, Balancing of rotating masses in one and different planes.
Cams and follower: Introduction, classification of followers and cams, terms used in radial cams, motion of the follower- Uniform and Simple harmonic motion.

Text Books:

1. Theory of Mechanisms and Machines Jgdish Lal 1991. Metropolitan Book Co. Pvt. Ltd., Netaji Subash Marg, New Delhi.
2. Theory of Machines, Khurmi R S and Gupta JK 1994. Eurasia Publishing House Pvt. Ltd., Ram Nagar, New Delhi.
3. Machine Design–Khurmi R.S. and Gupta J.K, Eurasia Publishing House Pvt. Ltd., New Delhi, 1996.
4. Design of machine elements, by Bhandari, McGraw Hill Education India Private Limited; Fourth edition, 2017.
5. Farm Machinery Design Principles &Problems by Sharma D N, Jain Bros, 2013.
6. Design of Machinery by Robert L. Norton, McGraw-Hill Education, edition, 2013.

Reference Books:

1. Theory of Machines, Thomas Bevan 1984. CBS Publishers
2. Theory of Machines, Ballaney P L 1985 Khanna Publishers, 2- B Nath Market, NaiSarak, New Delhi
3. Mechanisms and Machine Theory, Rao J S and Dukkipatti R V 1990. Wiley Astern Ltd., New Delhi
4. Theory of Machines, Rattan S B 1993. Tata McGraw Hill Publishing Co. Ltd., 12/4 Asf Ali Road, New Delhi
5. Machine Design– Jain R.K. 1991. Khanna Publishers, New Delhi.
6. Machine Design Data Handbook by Patil H.G, IK International Publishing

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HousePvt.Ltd,2011.

7. Machine Design, by Pearson, Pearson Education; Fifth edition, 2018
8. Shigley's Mechanical Engineering Design, by Richard GBudynas; J Keithisbett, McGraw Hill Education; First edition, 2017.

Web Links:

1. https://nptel.ac.in/downloads/112105125/#
2. http://ecoursesonline.iasri.res.in/course/view.php?id=521
3. https://lecturenotes.in/subject/261/machine-design-md

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AGRICULTURAL PROCESS ENGINEERING AND FOOD QUALITY

V Semester **L T P C**
Course Code: 191AG5T11 **2 1 0 3**

Course Objectives:

COB 1: To impart knowledge on various unit operations in agricultural process engineering.
COB 2: To make students to acquire knowledge on size reduction, mixing, separation, drying, milling and material handling.
COB 3: To enable the students to understand about food laws and regulation in India.

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1 : Explain the functions of various unit operations and working of size reduction equipments for processing of fibrous and dry size reduction in processing of agriculture produce.
CO 2 : Explain the design and working of mixing equipments for powder, high and low viscosity liquids.
CO 3 : Classify separator equipments based on physical characteristics of grains.
CO 4 : Identify various methods for determining moisture content, EMC and drying process.
CO 5 : Explain the importance, design and working of milling and material handling devices.
CO 6 : Explain food quality control, food laws, food standards and HACCP.

Mapping of course outcomes with program outcomes:

CO's/PO's	PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K3)	PO6 (K3)	PO7 (K2)	PO8 (K3)	PO9 (K2)	PO10 (K2)	PO11 (K3)	PO12 (K1)
CO1 (K2)	2	1	-	-	2	-	-	-	-	-	-	-
CO2 (K2)	2	1	-	-	2	-	-	-	-	-	-	-
CO3 (K2)	2	1	-	-	2	-	-	-	-	-	-	-
CO4 (K4)	3	3	3	3	3	-	-	-	-	-	-	-
CO5 (K3)	3	2	1	1	3	-	-	-	-	-	-	-
CO6 (K5)	3	3	-	3	3	-	-	-	-	-	-	-

Mapping of course outcomes with program Specific Outcomes:

CO's/PSO's	PSO1 (K3)	PSO2 (K3)	PSO3 (K4)
CO1 (K2)	2	-	1
CO2 (K2)	2	-	-
CO3 (K2)	2	-	-
CO4 (K4)	3	3	3
CO5 (K3)	3	3	2
CO6 (K5)	3	-	3

UNIT-I:

Unit operation in agricultural Processing:
Scope and importance crop processing – principles and methods of food processing, cleaning, grading, screening, scalping, sorting, size reduction, mixing, separation, drying, storage, milling, material handling, packaging, baking.

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Size reduction:
Size reduction –principle of comminution/size reduction, particle shape, average particle size, crushing efficiency. Determination and designation of the fineness of ground material, screen analysis, Empirical relationships (Rittinger's, Kick's and Bond's equations) and related problems. Size reduction equipment – Crushers (Jaw crusher, Gyratory crusher, Crushing rolls), Grinders (Attrition mill, Hammer mill, Ball mill), Fine grinders (Rietz mill or disintegrator, Dispersion and colloid mills) and Cutting machines (Rotary knife cutter).

UNIT-II:

Mixing:
Mixing –Introduction, theory of solids mixing, Mixing of low and moderate viscosity liquids (paddle mixer, turbine mixer, propeller mixer) its applications. Mixing of high viscosity liquids, pastes and plastic solids (pan mixer, kneaders) its applications.
Mixers for dry powders and particulate solids (Horizontal screw and ribbon mixer, Vertical screw mixer, Tumbling mixer) and its applications, mixing index,

Separator units:
Theory of separation, types of separators, separator based on length, width, shape of the grains, specific gravity, density, cyclone separators, Pneumatic separator. Air-screen grain cleaner principle and types, Design considerations of air-screen grain cleaners, Sieve analysis- particle size determination, Ideal screen and actual screen–effectiveness of separation and related problems.

UNIT-III:

Drying:
Moisture content and its representation (wet basis, dry basis), methods for determination moisture content (direct and indirect methods) and related problems, Importance of EMC and methods of determination (static-dynamic methods), EMC models, hysteresis effect, bound, unbound and free moisture. Principles of drying, theory of diffusion, mechanism of drying, falling rate, constant rate period, thin layer, deep bed dying methods, Effect of different factors on the drying process, types of dryers.

UNIT-IV:

Milling and Material handling devices:
Rice milling, principles and equipments, paddy parboiling methods and milling equipment, milling of pulses and oilseeds. Scope and importance of material handling devices, Belt Conveyor– idlers, idler spacing, belt tension, Bucket elevator–classification, operation, capacity, drive mechanism, advantages and disadvantages. Screw conveyor – Principle of operation, capacity, power requirement. Pneumatic conveying system- types, limitations of pneumatic conveying system.

UNIT-V:

Food Quality: Concept, objectives and importance. Sensory evaluation or organoleptic evaluation of food quality, Food laws and regulations in India. Food grade and standards –BIS, AGMARK, PFA, FPO. Hazard analysis and critical
control point (HACCP) – objectives, principles, Steps involved in implementation of HACCP.

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Text Books:

1. Unit Operations of Agricultural Processing, Sahay KM and Singh KK, Vikas Publishing House Pvt. Ltd., New Delhi.
2. Post-Harvest Technology of Cereals, Pulses and oil seeds, Chakraverty A, Oxford and IBH Publishing. Ltd., Calcutta.
3. Unit operations in Food processing, Earle R L, Pergamon Press, New York.

Reference Books:

1. Transport Processes and separation Process Principle, Geankoplis C J Prentice-HallInc., New Jersey.
2. 2. Unit Operations of Chemical Engineering, McCabe WL, Smith JC and Harriott PMcGraw-Hill Book Co., Boston.
3. 3. Fellows, P. Food Processing Technology. CRCPress
4. 4. McCabe, W.L., J.C.Smith and P.Harriot. Unit Operations of Chemical Engineering. McGrawHill. Inc. Kosaido Printing Ltd. Tokyo, Japan.

Web Links:

1. http://www.cigr.org/documents/CIGRHandbookVol4.pdf
2. http://www.rpaulsingh.com/Learning and teaching resources
3. http://ecoursesonline.iasri.res.in/course/view.php?id=22
4. https://moodle.ufsc.br/pluginfile.php/772348/mod_resource/content/0/UnitOperations_in_Food_Engineering_-_A._Ibarz_G._BarbosaCanovas_CRC_2003_WW.pdf
5. http://www.nzifst.org.nz/unitoperations/matlenerg2.htm

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ENGINEERING PROPERTIES OF BIOLOGICAL MATERIALS

(Professional Elective-I)

V Semester **L T P C**
Course Code: 191AG5E01 **2 1 0 3**

Course Objectives:

- COB 1: To enable the students to understand the principles and concepts of various properties of biological materials.
- COB 2: To understand the concepts of rheology and different rheological models.
- COB 3: To acquire the knowledge on physical, thermal, electrical, frictional and areo dynamic properties of food.
- COB 4: To make the students to learn the fundamental concepts of the basic properties of food materials and enable them to process, preserve and use them for various applications.

Course Outcomes:

At the end of the Course, Student will be able to:

- CO 1 : Choose the basic applications and importance of engineering properties in handling and processing equipment and also storage structures.
- CO 2 : Analyze the Maxwell and Kelvin model equations in the rheology for important biological materials.
- CO 3 : Explain about frictional, electrical, thermal and aerodynamics properties of food.
- CO 4 : Explain about process design.

Mapping of course outcomes with program outcomes:

CO's/ PO's	PO 1 (K3)	PO 2 (K4)	PO 3 (K5)	PO 4 (K5)	PO 5 (K3)	PO 6 (K3)	PO 7 (K2)	PO 8 (K3)	PO 9 (K2)	PO 10 (K2)	PO11 (K3)	PO12 (K1)
CO1 (K2)	3	1	-	-	-	-	-	-	-	-	2	2
CO2 (K5)	-	3	3	3	3	-	-	-	-	-	3	3
CO3 (K3)	3	2	1	1	-	-	-	-	-	-	-	3
CO4 (K5)	3	3	-	3	3	-	-	-	-	3	-	-

Mapping of course outcomes with program Specific Outcomes:

CO's/PSO's	PSO 1 (K3)	PSO 2 (K3)	PSO 3 (K4)
CO1 (K2)	2	-	-
CO2 (K5)	-	3	3
CO3 (K3)	3	3	2
CO4 (K5)	-	3	3

UNIT-I:

Physical Properties: Introduction and application of engineering properties of biological material. Physical properties of different food commodities and aided products – importance. Shape and size – criteria for describing shape and size. Roundness and sphericity – Volume and density – Specific gravity – Bulk density. Porosity – surface area – measurement of the same.

UNIT-II:

Rheology: Introduction to rheology, basic concepts, Classification of rheology, ASTM standard definition of terms. Rheological Properties, Flow behavior of

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biological materials, force deformation curve; linear elastic limit, yield point, bio- yield point and rupture point. Stress relaxation and creep behavior. Visco-elasticity and visco-plasticity.

UNIT-III:

Rheological models: Introduction to mechanical models. Kelvin and maxwell models. Electrical equivalence of mechanical models. Rheological equations of maxwell model, generalized maxwell model, kelvin model and generalized kelvin model. Difference between kelvin and maxwell model. Viscosity; Measurement of viscosity using viscometer, types of viscometer, problems on viscometer.

UNIT-IV:

Frictional Properties: Basic concepts, effect of load sliding velocity. Friction in agricultural materials, measurement. Rolling resistance, angle of internal friction and angle of repose. Applications of frictional properties in design of processing equipment.

Aerodynamic Properties: Importance of aerodynamic properties in Agricultural Processing equipments with examples. Terminal velocity and drag coefficient; frictional drag and profit drag or pressure drag. Terminal velocity of different grains, working of pneumatic conveyor based on aerodynamic properties.

UNIT-V:

Electrical properties: Di-electrical properties; Dielectric loss factor and dielectric constant. Applications and role of electrical properties in food processing.

Thermal Properties: Introduction to thermal properties; Specific heat, thermal conductivity, thermal diffusivity, latent heat of vaporization, latent heat of fusion, sensible heat, enthalpy and heat energy calculation.

Text Books:

1. Physical properties of plant and animal materials, Mohsenin N N, Gordon and Breach Science Publishers, New York, 2nd edition ,1986.
2. Engineering Properties of Foods, Rao M A, Syed S H Rizvi and Ashim K Datta, CRC Press – Taylor & Francis Group, Boca Raton, FL, 4th edition, 2014

Reference Books:

1. Food and Process Engineering Technology, Wilhelm LR, Suler W A and Brusewitz, G H, American Society of Agricultural Engineers (ASAE), St. Joseph, MI.
2. Engineering Properties of Biological Materials, O.P. Singhal and D.V.K. Samuel, Saroj Prakashan, Allahabad, 1st edition, 2003.

Web Links:

1. http://ecourses.iasri.res.in/email_authentication.aspx?Degree_Id=04
2. http://ecoursesonline.iasri.res.in/course/view.php?id=25
3. http://www.cigr.org/documents/CIGRHandbookVol4.pdf
4. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=1011
5. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=1013
6. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=1025

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AGRICULTURAL MACHINERY AND EQUIPMENT

		L	T	P	C
VI Semester					
Course Code:	**191AG6T14**	**2**	**1**	**0**	**3**

Course Objectives:

COB 1: To identify the need of farm mechanization in India and equip the students with technical knowledge and skills required for the operation, maintenance and evaluation of farm machinery.

COB 2: To enrich the students with mathematical, experimental and computational skills for solving different field problems.

COB 3: To equip the students with technical knowledge and skills required for the operation, maintenance, testing and modification of different agricultural machines.

Course Outcomes:

At the end of the Course, Student will be able to:

CO 1: Familiar with farm mechanization, and able to identify the major functional components and forces acting on various tillage implements. Hitching systems.

CO 2: Understand and evaluate the Calibration of seed-drills and planters. Familiar with plant protection equipments. Evaluate the calibration of sprayers.

CO 3: Familiar with inter-culture equipments and understand the harvesting and threshing operation with various implements used for these operations.

CO 4: Familiar with inter-culture equipments and understand the harvesting and threshing operation with various implements used for these operations.

CO 5: Familiar with combines, cotton harvester.

Mapping of course outcomes with program outcomes:

CO/PO	PO 1 (K3)	PO 2 (K4)	PO 3 (K5)	PO 4 (K5)	PO 5 (K3)	PO 6 (K3)	PO 7 (K2)	PO 8 (K3)	PO 9 (K2)	PO 10 (K2)	PO 11 (K3)	PO 12 (K1)
CO1 (K1)	3	-	-	-	-	-	-	-	-	-	-	-
CO2 (K3)	2	1	-	-	-	-	-	-	3	3	2	3
CO3 (K2)	3	3	2	-	-	-	-	-	-	-	-	3
CO4 (K2)	3	3	-	3	-	-	-	-	-	-	-	-
CO5 (K3)	3	3	-	-	-	-	-	-	-	-	-	-

Mapping of course outcomes with program Specific Outcomes:

CO's/PSO's	PSO 1 (K3)	PSO 2 (K3)	PSO 3 (K4)
CO1 (K1)	3	3	2
CO2 (K3)	2	2	1
CO3 (K2)	3	3	3
CO4 (K2)	3	3	3
CO5 (K3)	3	3	3

UNIT-I:

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Introduction to farm mechanization. Classification of farm machines. Introduction to materials used in construction of farm machines. Heat treatment processes and their requirement in farm machines. Selection of farm machinery and cost estimation. Hitching systems and controls of farm machinery. Introduction to seed-bed preparation. Familiarization with land reclamation and earth moving equipment. Methods of Ploughing.

UNIT-II:

Tillage Practices: Definition, primary tillage, secondary tillage, rotary tillage, deep tillage, minimum tillage and conservation tillage. Draft measurement of tillage equipment, Identification and major functional components of mould-board plough, disc plough, chisel plough, sub-soiler, harrows, cultivators, levelling, Forces acting on tillage implements. Cost of operation of farm machinery.

UNIT-III:

Introduction to inter-culture equipments: Weeder – manual and powered, main components and their functional requirement.

Introduction to sowing, planting & transplanting equipment: Study of working of seed drills, no-till drills, happy seeder and strip-till drills. Brief description and working of planters. Study of types of furrow openers and metering systems in drills and planters. Calibration of seed-drills/ planters. Adjustments during operation. Introduction to plant protection equipment – sprayers and dusters.

Classification of sprayers. Types of nozzles. Calculations for calibration of sprayers and chemical application rates.

UNIT-IV:

Study of harvesting operation – methods and terminology. Study of Reapers, Mowers and windrowers – types, working and adjustments. Introduction to threshing systems – manual and mechanical systems. Types of threshing drums and their applications. Types of threshers- tangential and axial, factors affecting thresher performance. Chaff cutters and capacity calculations.

UNIT-V:

Study of grain combines (Wheat and Paddy)- Combine terminology, Computation of combine losses, study of combine troubleshooting. Study of Root crop diggers –potato and groundnut. Cotton harvesting mechanisms, study of cotton pickers and strippers. Introduction to vegetables and fruit harvesting equipment and tools.

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Text Books:

1. Principles of Agricultural Engineering (Vol. II). A. M. Michael and T.P. Ojha, (1985), Jain brothers, New Delhi.
2. Principals of Farm Machinery, R.A. Kepner, Bainer Roy, and E.C. Barges, (1978), Publishers and Distributors, Delhi-17
3. Theory, Construction and Calculation of Agricultural Machines (Vol. 1 and 2), Bosoi, E.S. (1990). Oxonion Press Pvt. Ltd., New Delhi.
4. Farm Machinery, T.P. Singh, (2017). PHI Learning Pvt Ltd, New Delhi-110012.

Reference Books:

1. Kanafoshi, C.Z. and Karwawshi, T. (1976). Agricultural Machines, Theory and Construction (Vol. 1 & 2).
2. Kelnin, N.I.,Popov, I.F., and Sakun, V.A. (1985). Agricultural Machines. Amerind Publishers, New Delhi.
3. Srivastava, A. K., Goering, C. E., Rohrbach, R. P., & Buckmaster, D. R. (1993). Engineering principles of agricultural machines.

Web Links:

1. https://nptel.ac.in/courses/126/105/126105009/
2. http://www.hillagric.ac.in/edu/coa/agengg/lecture/243/agriengg-243.htm

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DESIGN OF AGRICULTURAL MACHINERY

(Professional Elective-III)

VI Semester **L T P C**
Course Code: 191AG6E07 **2 1 0 3**

Course Objectives:

COB 1: To make students know the basic concepts of machine design.
COB 2: To enable the students to apply the basic concepts of machine design in designing various machine parts and element.
COB 3: To impart the knowledge on designing an agricultural implements by application of individual machine member design.

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1: Understand the basic concept of machine design.
CO 2: Examine basic principles in designing of cotter joint, knuckle joint, levers and springs.
CO 3: Apply principles of design to mechanical power transmission elements such as shafts, keys & couplings, bearings.
CO 4: Explain the design procedure of flywheel.
CO 5: Classify the types of bearing used in machine design.
CO 6: Apply principles of design in designing farm machinery implements.

Mapping of course outcomes with program outcomes:

CO's/PO's	PO1 (K3)	PO2 (K4)	PO3 (K5)	PO4 (K5)	PO5 (K3)	PO6 (K3)	PO7 (K2)	PO8 (K3)	PO9 (K2)	PO 10 (K2)	PO11 (K3)	PO12 (K1)
CO1 (K2)	2	1	--	--	2	--	--	--	--	--	--	--
CO2 (K4)	3	3	2	2	--	--	--	--	--	--	--	--
CO3 (K3)	3	2	1	1	3	--	--	--	--	--	--	--
CO4 (K2)	2	1	--	--	--	--	--	--	--	--	--	--
CO5 (K4)	3	--	--	--	--	--	--	--	--	--	--	--
CO6 (K3)	3	2	1	1	3	--	--	--	--	--	--	--

Mapping of course outcomes with program Specific Outcomes:

CO's/PSO's	PSO 1 (K3)	PSO 2 (K3)	PSO 3 (K4)
CO1 (K2)	2	2	-
CO2 (K4)	3	-	3
CO3 (K3)	3	3	2
CO4 (K2)	2	-	-
CO5 (K4)	3	3	3
CO6 (K3)	3	3	2

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UNIT-I:

Introduction to Machine Design: Definition, classification and general considerations in machine design, general procedure in machine design. Simple stress in machine parts – tensile, compressive, bending and shear stress. Stress - strain diagram, working stress, factor of safety, stresses in composite bars, thermal stress. Principal stresses and principal planes. Theories of failure under static load - Rankine's theory, Guest's theory and maximum distortion theory. Stress concentration and notch sensitivity.

UNIT-II:

Shafts: Material used for shafts, types and sizes of shafts. Design of shafts based on axial, bending, twisting, combined bending and twisting, buckling and fluctuating loads. Design of shafts on the basis of deflection and rigidity.

Keys and couplings: Introduction, types of keys - sunk key, saddle key, tangent key, round key and splines. Forces acting on sunk key. Effect of key ways. Shaft couplings – definition and types, muff coupling, design of flange coupling.

UNIT-III:

Levers: Introduction, application of levers in engineering practice, design of levers - hand lever, foot lever and cranked lever.

Cotter joint: Types of cotter joints, design of socket and spigot cotter joint.

Knuckle joint: Dimensions of various parts of knuckles joint, methods of failure of knuckle joint, design procedure of knuckle joint.

Springs: Introduction, terminology, types of springs, material for helical springs, springs in series and parallel, flat spiral springs, leaf springs, construction of leaf springs.

UNIT-IV:

Fly wheel: Introduction, coefficient of fluctuation of speed, fluctuation of energy, maximum fluctuation of energy, energy stored in a flywheel, design of flywheel.

Bearing: Introduction, classification of bearing, types of sliding contact bearings, rolling contact bearings, radial ball bearings, advantages and disadvantages of rolling contact bearing over sliding contact bearings. Standard dimensions and designations of ball bearings, basic static load rating of rolling contact bearings, life of a bearing. Basic dynamic load rating of rolling contact bearings, dynamic load rating for rolling contact bearings under variable loads, reliability of bearing.

UNIT-V:

Design of Machinery: Design of agricultural machinery – Mould board plough, cultivator, Rotavator, tractor operated seed cum fertilizer drill, tractor mounted boom sprayer, harvesting and threshing equipment.

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Text Books:

1. Machine Design – Khurmi R.S. and Gupta J.K, Eurasia Publishing House Pvt. Ltd., New Delhi, 1996.
2. Design of machine elements, by Bhandari, McGraw Hill Education India Private Limited; Fourth edition, 2017.
3. Farm Machinery Design Principles & Problems by Sharma D N, Jain Bros,2013.

Reference Books:

1. Machine Design – Jain R.K. 1991. Khanna Publishers, New Delhi.
2. Machine Design Data Handbook by Patil H. G, I K International Publishing House Pvt. Ltd, 2011.
3. Machine Design, by Pearson, Pearson Education; Fifth edition,2018
4. Shigley's Mechanical Engineering Design, by Richard G Budynas; J Keith Nisbett, McGraw Hill Education; First edition, 2017.

Web Links:

1. https://nptel.ac.in/downloads/112105125/#
2. http://ecoursesonline.iasri.res.in/course/view.php?id=521
3. https://lecturenotes.in/subject/261/machine-design-md

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Department of Agricultural Engineering
Syllabus revision Index 2021-22

S.No	Name of the course	Percentage of syllabus change
1.	Thermodynamics, Refrigeration and Air Conditioning	20
2.	Tractor Systems and Controls	30
3.	Tractor Systems and Controls Lab	40
4.	Theory and Design of Agricultural Machinery	30
5.	Agricultural Process Engineering and Food Quality	20
6.	Engineering Properties of Biological Materials	20
7.	Agricultural Machinery and Equipment	40
8.	Agricultural Machinery and Equipment Lab	30

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1.1.2. Table-Prior/Post revision of syllabus

S.No.	Regulation	Pre-Revision	Post-Revision
	Course Title	Thermodynamics and Refrigeration System	Thermodynamics, Refrigeration and Air Conditioning
1	**Course Code**	191AG4T04	201AG3L03
	Syllabus	**UNIT-I:** **Introduction:** Introduction to thermodynamic system, boundary, surroundings, Classification of Thermodynamic system- closed, open and isolated system, Laws of conservation of energy, Definition of thermodynamic work and example of work, Thermodynamic properties, Laws of thermodynamic – first law, second law and Zeroth law, Gas laws-Boyles' law Charles Law and Gay Lussac's Law. Thermodynamic properties of perfect gases. Application of first law in heating and expansion of gases, Cycles-introduction-Applications, Carnot theorem-Carnot cycle, Entropy: Physical concept of entropy, Change of entropy of gases in thermodynamics.	**Unit –I:** Introduction: Basic concepts of thermodynamics: Thermodynamic System & Its Properties; Closed system-open system-isolated system, Gas laws- Boyles' law, Charles Law, Gay Lussac's Law, Laws of ideal gases- compression and expansion of gases; Laws of thermodynamic – First Law of Thermodynamics & Non Flow Processes- Non-Flow and Flow Processes, Second law of thermodynamics- Second Law, Entropy, Carnot Cycle, Entropy and Availability, General expression for Change in Entropy
		UNIT-II Engines: Classification, Components, working principles-Working cycle of 4-stoke and 2-stroke diesel and Petrol Engines, Comparison between 4 stroke and 2-stroke Diesel and Petrol Engines. **Power Cycle:** Otto, Diesel, Dual Combustion cycles – Description and representationon P–V and T-S Diagram, Air standard cycle efficiencies, Thermal Efficiency Heat engines, mean effective pressure, Measurement of indicated horse power, brake horse power, Heat balance calculations, Problems on IP, BP, Engine efficiencies and performances.	**UNIT-II** **Engines:** Classification, Components, working principles- Working cycle of 4-stoke and 2-stroke diesel and Petrol Engines, Comparison between 4 stroke and 2-stroke Diesel andPetrol Engines. **Power Cycle:** Otto, Diesel, Dual Combustion cycles – Description and representation onP–V and T-S Diagram, Air standard cycle efficiencies, Thermal Efficiency Heat engines,mean effective pressure, Measurement of indicated horse power, brake horse power, Heat balance calculations, Problems on IP, BP, Engine efficiencies and performances

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		UNIT-III **Principles of Refrigeration**: Definition of refrigeration, unit of refrigerating capacity, coefficient of performance, problems on refrigeration capacity Principles of refrigeration – Room air conditioner, domestic refrigerator, working substances in refrigeration machines, Production low temperatures-Expansion of a liquid with flashing, reversible adiabatic expansion of a gas, irreversible adiabatic expansion (throttling) of a real gas, thermoelectric cooling, adiabatic demagnetization. **Air Refrigeration System:** Working - Problems on reverse Carnot cycle, limitations of reversed Carnot cycle. Air refrigerators working on Bell Coleman cycle and Problems on Bell Coleman cycle.	**UNIT-III** **Principles of Refrigeration:** Units, Terminology; Refrigerating machine-the second lawinterpretation, heat engine vs heat pump vs refrigerating machine, Energy ratios or Coefficient of performance, Power consumption of a refrigerating machine, Refrigeration cycles- The Carnot principle, Reversed Carnot cycle and Bell Coleman cycle, Vapour & Gas as refrigerant in reversed Carnot cycle, Numerical problems; Production low temperatures- Expansion of a liquid with flashing, reversible adiabatic expansion of a · gas, irreversible adiabatic expansion (throttling) of a real gas, thermoelectric cooling, adiabatic demagnetization.
		UNIT – IV **Vapor refrigeration** – Vapor as a refrigerant in reversed Carnot cycle with P-V and T-s diagrams, problems on reversed Carnot cycle with vapor, **Vapor Compression Systems:** Modifications in reverse Carnot cycle with vapor as refrigerant (dry vs. wet compression, throttling Vs isentropic expansion), Vapor compression cycle and component, vapor compression system calculations, P-h diagram - enthalpy diagram, super heating, sub cooling, effect of suction vapor super heating, sub cooling, problems on vapor compression cycle, Liquid-vapor regenerative heat exchanger for vapor compression system,	**UNIT – IV** **Vapour Compression Systems:** Modifications in reverse Carnot cycle with vapor as refrigerant (dry vs. wet compression, throttling vs isentropic expansion), Vapor compression cycle and component, vapor compression system calculations, P-h diagram - enthalpy diagram, super heating, sub cooling, effect of suction vapor super heating, subcooling, problems on vapor compression cycle, Liquid-vapor regenerative heat exchanger for vapor compression system. **Vapor-Absorption Refrigeration System:** Working principle, component, Maximum coefficient of performance of a heat operated refrigerating machine; common refrigerant- absorbent systems. Common refrigerants and their properties- Definition of refrigerant, Classification of refrigerants, Designations of refrigerants, Properties of refrigerants, Selection of refrigerants, Thermodynamic requirements, Chemical requirements, Physical requirements

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		UNIT –V **Vapor-Absorption Refrigeration System:** Working principle, component, calculation, maximum coefficient of performance of a heat operated refrigerating machine, problems on vapor absorption refrigerating system, common refrigerant-absorbent systems. **Psychrometric:** Thermodynamic properties of moist air, Elementary psychrometric process. **Cold Storage**: Principal of cold storage, component of cold storage and operation	**UNIT –V** **Psychrometric:** Psychrometric Properties- Dry air, moist air, water vapour, wet bulb temperature, Dry bulb temperature, dew point temperature, specific humidity, absolute humidity, degree of saturation, Relative humidity, Sensible heat of air, Total heat of air, Humid specific volume, thermodynamic wet bulb temperature or temperature of adiabatic saturation process, psychometric chart and its use. **Air conditioning**– principles –Type and functions of air conditioning, Basic processes in conditioning of air, Psychrometric processes in Air-conditioning equipment; Simple Air-conditioning system and state & mass rate of supply air; Summer air conditioning, Winter air conditioning; Fundamentals of design of air conditioning systems-humidifiers and dehumidifiers – cooling load calculations, types of air conditioners – applications

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		Additives in the coolant.Study of radiator efficiency. Study of ignition system of SI engines. Study of electrical system including battery, starting motor, battery charging, cut-out, etc. Comparison of dynamo and alternator. Familiarization with the basics of engine testing.	**Lubrication system**: Lubricant types and study of their properties – lubricating oil tests - system working principles and construction details. **Cooling system** – purpose of cooling - Air cooling – water cooling – pressurized cooling - Study of properties of coolants, antifreeze and anti-corrosion materials - system working principles and construction details
		UNIT III: Study of need for transmission system in a tractor. Transmission system – types, major functional systems. Study of clutch – need, types, functional requirements, construction and principle of operation. Familiarization with single plate, multi-plate, centrifugal and dual clutch systems. Study of Gear Box – Gearing theory, principle of operation, gear box types, functional requirements, and calculation for speed ratio. Study of differential system – need, functional components, construction, calculation for speed reduction. Study of need for a final drive. Study of Brake system – types, principle of operation, construction, calculation for braking torque. Study of steering system – requirements, steering geometry characteristics, functional components, calculation for turning radius. Familiarization with Ackerman steering. Steering systems in track type tractors.	**UNIT-III:** **Steering system** – Qualities of Steering mechanism, Main parts of steering mechanism. Types of steering boxes – working of hydraulic steering, parameters of steering systems-caster angle, camber angle, kingpin inclination and toe-in. **Power transmission system:** Functions of a power transmission system. Clutch – Necessity of clutch in a tractor – Essential features of good clutch –Principalworking of clutch - Types of clutch – Friction clutch-Single Plate clutch, dual clutch and double clutch, Dog clutch and Fluid coupling — constructional detailsand principle of working mechanism. Gearbox– Necessity for providing gearbox – selective sliding type, constant mesh type and partial constant mesh gears – Torque ratio in Gears – working of Gearbox – torqueconverter.
		UNIT IV: Study of Hydraulic system in a tractor – Principle of operation, types, main functional components, functional requirements. Familiarization with the Hydraulic system adjustments and ADDC. Study of tractor power outlets – PTO. PTO standards, types and functional requirements. Introduction to traction. Traction terminology. Theoretical calculation of shear force and rolling resistance on traction device. Study of wheels and tyres – Solid tyres and pneumatic tyres, tyre construction and tyre specifications. Study of traction aids.	**UNIT-IV:** **Differential unit**– Functions of crown wheel – Differential lock – functions. Finaldrive – functions of Final drive. **Brake system** – Principle of operation - Requirements of good braking systems –classification of brakes – Mechanical brake, Hydraulic brake and oil immersed brake working mechanism. **Hydraulic control system** – working principals – Basic components of Hydraulicsystem – Types of hydraulic system – Position control –Draft control – Mixed control Precautions for hydraulic system.

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2	**Regulation**	**Pre-Revision**	**Post-Revision**
	Course Title	Farm Power and Tractor Systems	Tractor Systems and Controls
	Course Code	191AG4T05	201AG4T06
	Syllabus	**UNIT-I:** Study of sources of farm power – conventional & non-conventional energy sources. Classification of tractors and IC engines. Review of thermodynamic principles of IC (CI & SI) engines and deviation from ideal cycle. General energy equation and heat balance sheet. Study of mechanical, thermal and volumetric efficiencies. Study of engine components their construction, operating principles and functions. Study of engine strokes and comparison of 2-stroke and 4-stroke engine cycles and CI and SI engines. Study of Engine Valve systems, valve mechanism, Valve timing diagram, and valve clearance adjustment Study of Cam profile, valve lift and valve opening area. Study of importance of air cleaning system. Study of types of air cleaners and performance characteristics of various air cleaners. Study of fuel supply system. Study of fuels, properties of fuels, calculation of air-fuel ratio. Study of tests on fuel for SI and CI engines. Study of detonation and knocking in IC engines	**UNIT-I:** Introduction of farm tractor – History and development - classification and selection of farm tractors. Energy sources of Farm Power-Classification of I.C Engines – Study of I.C Engine components and their construction, operating principles and functions – Valves and valve working mechanism. Terminology connected with engine power - measurement of engine power – solved problems
		UNIT II: Study of carburetion system, carburetors and their main functional components. Study offuel injection system – Injection pump, their types, working principles. Fuel injector nozzles – their types and working principle. Engine governing – need of governors, governor types and governor characteristics. Study of lubrication system –need, types, functional components. Study of lubricants – physical properties, additives and their application. Engine cooling system – need, cooling methods and main functional components. Study of need and type of thermostat valves.	**UNIT-II:** **Electrical & ignition systems**: Spark and magneto ignition system - working principles and construction details. **Engine fuel system:** I.C Engine fuels – their properties – Detonation and knocking in IC engines– fuel test – system working principles and construction details – turbo charger- fuel filter – Air cleaner – solved problems. **Engine governing system**: principles – classification - system working principles and construction details – governor hunting – governor regulation.

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			Three-point linkage system – Dash board of tractor – tractor tyre, front and rarewheels, axle – track width adjustment of front wheels.
		UNIT V: Study of tractor mechanics – forces acting on the tractor. Determination of CG of a tractor. Determination and importance of moment of inertia of a tractor. Study of tractor static equilibrium, tractor stability especially at turns. Determination of maximum drawbar pull. Familiarization with tractor as a spring-mass system. Ergonomic considerations and operational safety. Introduction to tractor testing. Deciphering the engine test codes.	**UNIT-V:** **Tractor power out lets**: P.T.O. Construction details– Belt pulley constructional details - Draw bar construction details. **Traction and traction theory:** Traction efficiency – Methods for improving traction – Coefficient of traction – Rolling resistance – Wheel slip or Track slip – Rimpull – crawler tractor. **Center of Gravity**: Suspension method – Balancing method – Weighing method.**Tractor Chassis:** Functions of chassis frame – Tractor chassis – Mechanics of Tractor chassis.

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S.No.	Regulation	Pre-Revision	Post-Revision
	Course Title	Farm Power And Tractor Systems Lab	Tractor Systems And Controls Lab
3	**Course Code**	191AG4L05	201AG4L04
	Syllabus	1. To study the constructional details of tractors and power tillers of various make and to measure the chassis parameters. 2. To familiarize with tractor controls and to practice the driving of tractor inforward and reverse gears – driving safety rules. 3. To study constructional details of engine components- Assembling and dismantling. 4. To measure PTO or Engine power by using dynamometer. 5. To study the maintenance of air fuel system – cleaning of air – Process to remove air lock in the diesel engine – Precautions in handling diesel fuels in diesel engine. 6. To study the maintenance of lubrication and cooling system– Troubles and remedies – Care and maintenance of lubrication and cooling system. 7. To study the maintenance of transmission system – General maintenance – Differential trouble shooting – Frequent troubles and Remedies. 8. To study the maintenance of electrical system – Ignition system in petrol engine and starting system of diesel engine tractors –working – care and maintenance. 9. To study the maintenance of clutch and brakes – principle operation –frequenttroubles and remedies – care and maintenance. 10. To study the maintenance of steering system – principle of operation – troubleshooting of steering system – care and maintenance of steering system. 11. To study the maintenance of hydraulic system – Working	1. Introduction to different systems of CI engines; Engine parts and functions, working principles etc. 2. Study, construction and adjustments of Valve system. 3. Study of air cleaning system and fuel supply system of SI engine. 4. Study of Lubricating system and its adjustments. 5. Introduction to transmission systems and components. 6. Study of clutch functioning, parts and design problem on clutch system. 7. Study of different types of gear box, calculation of speed ratios, design problems on gear box. 8. Study on differential and final drive and planetary gears. 9. Study of brake systems and some design problems. 10. Study of hydraulic systems in a tractor, hydraulic trainer and some design problems. 11. Determination of location of CG of a tractor, Moment of Inertia of a tractor. 12. Visit to engine manufacturer/ assembler/ spare parts agency

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		principle – Basic components of hydraulic system – Position and Draft controls – Frequent troublesand Remedies – Repairs and maintenance of hydraulic system–Precautions of hydraulic system. 12. To study hitching and unhitching of an implement to a tractor.	
		LIST OF AUGMENTED EXPERIMENTS (Any two of the following experiments can be performed) 13. To study the emission of smoke – Over heating of engines. 14. To study the components and working of 2 stroke engine and 4 stroke engine. 15. To study tractor testing procedure – types of tests – test at main power take off – test at varying speed at full load – Test at varying load – Belt or pulley shaft test. 16. Visit to tractor repairing workshop or tractor industrial visit.	**LIST OF AUGMENTED EXPERIMENTS** (Any two of the following experiments can be performed) 13. Determination of physical properties of Oil & Fuel. 14. Tractor engine heat balance and engine performance curves. 15. Appraisal of various controls in different makes tractors in relation to anthropometric measurements. 16. Determination of traction performance of a traction wheel.

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5	Regulation	Pre-Revision	Post-Revision
	Course Title	Agricultural process engineering	Agricultural process engineering and food quality
	Course Code	171AG5T11	191AG5T11
	Syllabus	**Unit Operation In Agricultural Processing:** Scope and importance crop processing – principles and methods of food processing, cleaning and grading of cereals, pulses & oilseeds. **Size Reduction:** Principles. Size reduction –principle of comminution/ size reduction, mechanisms of comminution of food, particle shape, average particle size. Characteristics of comminuted products, crushing efficiency. Determination and designation of the fineness of ground material, screen analysis, Empirical relationships (Rittinger's, Kick's and Bond's equations).Size reduction equipment –hammer mills and impactors, attrition mills, burr mill, tumbling mills, action in tumbling mills, Size reduction equipment –Ultra fine grinders(classification hammer mills, colloid mill), cutting machines (slicing, dicing, shredding, pulping)	**UNIT-I:** **Unit operation in agricultural Processing:** Scope and importance crop processing – principles and methods of food processing, cleaning, grading, screening, scalping, sorting, size reduction, mixing, separation, drying, storage, milling, material handling, packaging, baking. **Size reduction:** Size reduction –principle of comminution/size reduction, particle shape, average particle size, crushing efficiency. Determination and designation of the fineness of ground material, screen analysis, Empirical relationships (Rittinger's, Kick's and Bond's equations) and related problems. Size reduction equipment – Crushers (Jaw crusher, Gyratory crusher, Crushing rolls), Grinders (Attrition mill, Hammer mill, Ballmill), Fine grinders (Rietz mill or disintegrator, Dispersion and colloid mills) and Cutting machines (Rotary knife cutter).
		UNIT –II **Mixing:** Mixing –Introduction, theory of solids mixing, criteria of mixer effectiveness and mixing index for granular solids, mixing indices, criteria of mixer effectiveness and mixing index for pastes and semi-solid masses, rate of mixing, theory of liquid mixing, power requirement for liquids mixing. Mixing equipment – Mixers for low or medium viscosity liquids (paddle agitators, impeller agitators, and powder-liquid contacting devices), mixers for high viscosity liquids and	**UNIT-II:** **Mixing:** Mixing –Introduction, theory of solids mixing, Mixing of low and moderate viscosity liquids (paddle mixer, turbine mixer, propeller mixer) its applications. Mixing of highviscosity liquids, pastes and plastic solids (pan mixer, kneaders) its applications. Mixers for dry powders and particulate solids (Horizontal screw and ribbon mixer, Vertical screw mixer, tumbling mixer) and its applications, mixing index, **Separator units:** Theory of separation, types of separators, separator based on length, width, shape of the grains, specific gravity, density, cyclone separators,

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		pastes, mixers for dry powders and particulate solids.	Pneumatic separator. Air- screen grain cleaner principle and types, Design considerations of air-screen grain cleaners, Sieve analysis- particle size determination, Ideal screen and actual screen– effectiveness of separation and related problems.
		UNIT-III **Separator Units:** Theory of separation, types of separators, separator based on length, width, and shape of the grains, specific gravity, density cyclone separators, Pneumatic separator. Air-screen grain cleaner principle and types, Design considerations of air-screen grain cleaners, Sieve analysis- particle size determination, Ideal screen and actual screen–effectiveness of separation and related problems	**UNIT-III:** **Drying:** Moisture content and its representation (wet basis, dry basis), methods for determination moisture content (direct and indirect methods) and related problems, Importance of EMC and methods of determination (static-dynamic methods), EMC models, hysteresis effect, bound, unbound and free moisture. Principles of drying, theory of diffusion, mechanism of drying, falling rate, constant rate period, thin layer, deep bed dying methods, Effect of different factors on the drying process, types of dryers.
		UNIT –IV **Drying:** Moisture content and methods for determination, moisture content representation, wet basis, dry basis, direct andindirect methods of moisture content determination, problems, Importanceof EMC and method of determination,static-dynamic methods, EMC curve and EMC models, hysteresis effect, bound, unbound and free moisture.Principles of drying, theory of diffusion, mechanism of drying, falling rate, constant rate period, thin layer, deep-bed dying methods, Effect of differentfactors on the drying process, types of dryers	**UNIT-IV:** **Milling and Material handling devices:** Rice milling, principles and equipments, paddy parboiling methods and milling equipment, milling of pulses and oilseeds. Scope and importance of material handling devices, Belt Conveyor– idlers, idler spacing, belt tension, Bucket elevator– classification, operation, capacity, drive mechanism, advantages and disadvantages. Screw conveyor – Principle of operation, capacity, power requirement. Pneumatic conveying system- types, limitations of pneumatic conveying system.
		UNIT –V **Milling and Material Handling Devices:** Rice milling, principles and equipments, paddy parboiling methods and equipment, wheat milling, milling ofpulses and oilseeds. Scope and importance of material handling devices, Belt Conveyor–Inclined belt conveyors, idler spacing,belt tension, drive tension, belt tripper, Screwconveyor – Principle of operation, capacity, power, troughs, loading and discharge.Bucket elevator–	**UNIT-V:** **Food Quality:** Concept, objectives and importance. Sensory evaluation or organoleptic evaluation of food quality, Food laws and regulations in India. Food gradeand standards –BIS, AGMARK, PFA, FPO. Hazard analysis and critical control point (HACCP) – objectives, principles, Steps involved in implementation of HACCP.

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		Principle, classification, operation, advantages, disadvantages, capacity, speed. Pneumatic conveyingsystem-capacity and power requirement, types, selection of pneumatic conveying system	

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6	Regulation	Pre-Revision	Post-Revision
	Course Title	Engineering Properties of Biological Materials And Food Quality	Engineering Properties of Biological Materials
	Course Code	171AG4T08	191AG5E01
	Syllabus	**UNIT – I** **Physical Properties**: Physical properties of different food grains, fruits and vegetables – importance. Shape and size – criteria for describing shape and size. Roundness and sphericity – Volume and density – Specific gravity – Bulk density. Porosity – surface area – measurement of the same	**UNIT-I:** **Physical Properties**: Introduction and application of engineering properties of biological material. Physical properties of different food commodities and aided products – importance. Shape and size – criteria for describing shape and size. Roundness and sphericity – Volume and density – Specific gravity – Bulk density. Porosity – surface area – measurement of the same.
		UNIT – II **Rheology:** Rheology – basic concepts – ASTM standard definition of terms. Rheological Properties – Force deformation behavior, stress and strain behavior. Visco – elasticity – time effects, Rheological models. Kelvin and Maxwell models – electrical equivalence of mechanical models. Rheological equations – Maxwell model and generalized Maxwell model. Kelvin model – generalized Kelvin model creep – stress relaxation.	**UNIT-II:** **Rheology:** Introduction to rheology, basic concepts, Classification of rheology,ASTM standard definition of terms. Rheological Properties, Flow behavior of biological materials, force deformation curve; linear elastic limit, yield point, bio- yieldpoint and rupture point. Stress relaxation and creep behavior. Visco-elasticity and visco-plasticity.
		UNIT – III **ENGINEERING PROPERTIES:** **Friction**: basic concepts – effect of load sliding velocity. Friction in agricultural materials –measurement – rolling resistance – angle of internal friction and angle of repose. **Aerodynamics of agricultural products**: drag coefficient – frictional drag and profit drag orpressure drag -and terminal velocity. **Electrical properties:** Di electrical properties. **Thermal Properties:** specific heat – thermal conductivity-thermal diffusivity. Application of engineering properties in handling and processing equipment and also storage	**UNIT-III:** **Rheological models:** Introduction to mechanical models. Kelvin and maxwell models. Electrical equivalence of mechanical models. Rheological equations of maxwell model, generalized maxwell model, kelvin model and generalized kelvin model. Difference between kelvin and maxwell model. Viscosity; Measurement of viscosity using viscometer, types of viscometer, problems on viscometer.

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		UNIT – IV **Food Quality:** Concept, objectives and importance. Food quality, control – methods of quality control sampling – purpose. Quality control – sampling techniques. Sampling procedures for liquid, powdered and granular materials. Sensory evaluation or organoleptic evaluation of food quality, methods. **Total Quality Management:** Parameters of total quality management. The evolution of total quality management – total quality management (TQM). Total quality control principles of qualitycontrol – consumer preference and acceptance	**UNIT-IV:** **Frictional Properties**: Basic concepts, effect of load sliding velocity. Friction in agricultural materials, measurement. Rolling resistance, angle of internal friction and angle of repose. Applications of frictional properties in design of processing equipment. **Aerodynamic Properties:** Importance of aerodynamic properties in Agricultural Processing equipments with examples. Terminal velocity and drag coefficient; frictional drag and profit drag or pressure drag. Terminal velocity of different grains, working of pneumatic conveyor based on aerodynamic properties
		UNIT – V **Food Laws:** Food laws and regulations in India. Food grade and standards –BIS, AGMARK, PFA, FPO. Sanitation in food industry – GMP. ISO 9000 series of standards. Hazard analysis and critical control point (HACCP) – objectives – principles – Steps involved in implementation of HACCP. Application of HACCP concept to milk and milk products – problems in implementing HACCP. FSSAI act 2006	**UNIT-V:** **Electrical properties:** Di-electrical properties; Dielectric loss factor and dielectricconstant. Applications and role of electrical properties in food processing. **Thermal Properties:** Introduction to thermal properties; Specific heat, thermal conductivity, thermal diffusivity, latent heat of vaporization, latent heat of fusion, sensible heat, enthalpy and heat energy calculation.

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4	Regulation	Pre-Revision	Post-Revision
	Course Title	Design of Agricultural Machinery	Theory And Design of Agricultural Machinery
	Course Code	171AG8E17	191AG5T10
	Syllabus	**UNIT-I:** **Introduction to Machine Design**: Definition, classification and general considerations in machine design, general procedure in machine design. Simple stress in machine parts – tensile, compressive, bending and shear stress. Stress - strain diagram, working stress, factor of safety, stresses in composite bars, thermal stress. Principal stresses and principal planes. Theories of failure under static load - Rankine's theory, Guest's theory and maximum distortion theory. Stress concentration and notch sensitivity	**UNIT-I:** Introduction, Element, Link, Pairs. Kinematic pairs- Types, lower and higher pairs. Mechanism, machine and structure. Kinematics chains- Four bar chain, slider crank chain and their inversions. **Belt, Rope and Chain Drives**: types of belt, rope and chain drives. Belt materials, Length of belt, Power transmitted, Velocity ratio, Belt size for flat and v-belts. Effect of centrifugal tension, creep and slip on power transmission. Problems on belt, rope and chain drives
		UNIT-II: **Cotter joint**: Types of cotter joints, design of socket and spigot cotter joint. **Knuckle joint:** Dimensions of various parts of knuckles joint, methods of failure of knucklejoint, design procedure of knuckle joint. **Levers**: Introduction, application of levers in engineering practice, design of levers - hand lever,foot lever and cranked lever. **Springs**: Introduction, terminology, types of springs, material for helical springs, springs inseries and parallel, flat spiral springs, leaf springs, construction of leaf springs	**UNIT-II:** **Gears:** Types of gears, Law of gearing. Velocity of sliding between two teeth in mesh Involute and cycloidal profile for gear teeth. Spur gear, nomenclature, interference and undercutting. Introduction to helical, spiral, bevel and worm gear. **Gear Trains**: Simple, compound, reverted and epicyclical gear trains - Determiningthe velocity ratio by tabular method
		UNIT III: **Shafts:** Material used for shafts, types and sizes of shafts. Design of shafts based on axial, bending, twisting, combined bending and twisting, buckling and fluctuating loads. Design of shafts on the basis of deflection and rigidity. **Keys and couplings**: Introduction, types of keys - sunk key, saddle key, tangent key, round key and splines. Forces acting on sunk key. Effect of key ways. Shaft couplings – definition and types, muff coupling,	**UNIT-III:** **Flywheel:** Turning moment Diagrams, Coefficient of fluctuation of speed and energy. Weight of fly wheel, flywheel applications. **Clutch**: Types of friction, Laws of dry fiction, Friction of pivots and collars. Singledisc, Multiple disc and cone clutches.

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		design of flange coupling.	
		UNIT IV: **Fly wheel**: Introduction, coefficient of fluctuation of speed, fluctuation of energy, maximum fluctuation of energy, energy stored in a flywheel, design of flywheel. **Bearing**: Introduction, classification of bearing, types of sliding contact bearings, rolling contact bearings, radial ball bearings, advantages and disadvantages of rolling contact bearingover sliding contact bearings. Standard dimensions and designations of ball bearings, basic static load rating of rolling contact bearings, life of a bearing. Basic dynamic load rating of rolling contact bearings, dynamic load rating for rolling contact bearings under variable loads, reliability of bearing.	**UNIT-IV:** **Shafts:** Material used for shafts, types and sizes of shafts. Design of shafts- basics, axial, bending, twisting, combined bending and twisting, buckling and fluctuating loads. **Keys and couplings**: Introduction, types of keys-sunk key, saddle key, tangent key, round key and splines. Forces acting on sunk key. Effect of keyways. Shaft couplings–definition and types, design of flange coupling, muffle coupling, Hooke's coupling.
		UNIT V: **Design of Machinery**: Design of agricultural machinery - cultivator, rotavator, tractor operatedseed cum fertilizer drill, tractor mounted boom sprayer, harvesting and threshing equipment.	**UNIT-V:** **Springs**: Introduction, terminology, types of springs, material for helical springs, springs in series and parallel, flat spiral springs, leaf springs, construction of leaf springs. **Balancing of Masses**: Static and dynamic balancing, Balancing of rotating masses inone and different planes. **Cams and follower**: Introduction, classification of followers and cams, terms usedin radial cams, motion of the follower- Uniform and Simple harmonic motion

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9	**Regulation**	**Pre-Revision**	**Post-Revision**
	Course Title	Farm Machinery And Equipment Lab-I	Agricultural Machinery and Equipment Lab
	Course Code	171AG8E17	191AG6L11
	Syllabus	1. To study the various farm machinery equipments. 2. To visit the industry and ICAR, SAU'S research stations for exposure on present usage of farm machinery. 3. To measure vertical suction, horizontal suction and throat clearance of MB plough. 4. To determine the field capacity and field efficiency of primary tillage implements. 5. To measure the draft and fuel consumption of different farm equipment. 6. To determine disc angle, tilt angle and concavity of a disc plough. 7. To study and practice the various field operation patterns/ploughing methods. 8. To calibrate the seed cum fertilizer drill. 9. To calibrate the sprayers. 10. To measure the furrow cross-section by using furrow profile meter. 11.To find soil resistance by using cone penetrometer. 12. To practice the hitching of different implements to the tractor **List of Augmented experiments (Any two of the following experiments can be performed)** **13. To study about testing and evaluation of farm implements.** 14. To find the weeding efficiency of different weeders. 15. To study the productivity of earth moving equipment through exposure visit. 16. To study and measure the adjustments of tractor-implement hitching.	1. Introduction to various farm machines. 2. Construction details, adjustments and working of M.B. plough, Disc ploughand Disc harrow and secondary tillage tools. 3. Implement performance for different implements under different soilconditions (Atleast two machines). 4. Tractor performance under different soil conditions. 5. Working of seed-cum-fertilizer drills, planters and their calibration in field. 6. Construction and working of rotavators and other rotary tillers, measurementof speed & working width. 7. Construction and working of rice and crop transplanter for potato, sugarcane, cotton etc., and their field operation patterns. 8. To study weeding equipment and their use. 9. Study of sprayers and dusters, measurement of nozzle discharge, fieldcapacity etc. 10. To study the various types of mowers, constructional details, materials andworking. 11. To study the various types of reaper, constructional details, materials used, working and performance. 12. Familiarization with various Farm machines related to harvesting, threshing, root harvesting, combine etc. (Groundnut diggers, Potato harvesters etc.) **List of Augmented Experiments: (Weeks 13 – Week 16** 13. To study about testing and evaluation of farm implements.

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		17. To study about maintenance of farm implements and equipment. 18. To practice the various sowing methods	14. To study the construction details of brush cutter. 15. To study balers construction in detail. 16. To study the various types of forage harvesters, constructional details, materials used and working

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7	Regulation	Pre-Revision	Post-Revision
	Course Title	Farm Machinery And Equipment-I	Agricultural Machinery And Equipment
	Course Code	171AG6T15	191AG6T14
	Syllabus	**UNIT-I** **Farm Mechanization:** Definition, concept of farm mechanization in India, status . of farm mechanization, mechanization index, objectives of farm mechanization, constraints in mechanization, scope and benefits of farm mechanization, limiting factors in farm mechanization, suggestions for farm mechanization. Farm power availability in India, sources of farm power, merits and demerits of different forms of power, classification of farm machines. **Materials of construction**- Ferrous metal and non-ferrous material and heat treatment of steel	**UNIT-I:** **Introduction to farm mechanization:** Classification of farm machines. Introduction to materials used in construction of farm machines. Heat treatment processes and their requirement in farm machines. Selection of farm machinery and cost estimation. Hitching systems and controls of farm machinery. Introduction to seed-bed preparation. Familiarization with land reclamation and earth moving equipment. Methods of Ploughing.
		UNIT-II **Tillage:** Definition, objectives of tillage, classification and types of tillage. Primary tillage implements: Indigenous plough and its parts, adjustments in indigenous plough. Mould board plough and its components, types of mould board ploughs, adjustments of mould board plough,plough accessories. Disc plough and types of disc plough, terminology related to disc plough and adjustments of disc plough; subsoiler, chisel plough, rotary plough, rotating auger ploughand rotavators. Ploughing operations: Terminology and methods of ploughing. Plough hitchingterminology: center of pull, center of plough load, line of pull, horizontal hitch adjustments, and vertical hitch adjustments. Secondary tillage equipment: Harrows, cultivators, clod crushers, levellers and other implements, puddler, bund former, ridger, soil scoop, green manure trampler. Miscellaneous equipment: post- hole digger, hydroger, ditcher, shrub cutter, blade terrace, hydraulic scraper.	**UNIT-II:** **Tillage Practices:** Definition, primary tillage, secondary tillage, rotary tillage, deep tillage, minimum tillage and conservation tillage. Draft measurement of tillage equipment, Identification and major functional components of mould-board plough, disc plough, chisel plough, sub-soiler, harrows, cultivators, levelling, Forces acting on tillage implements. Cost of operation of farm machinery.
		UNIT-III	**UNIT-III:** **Introduction to inter-culture**

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		Tillage performance parameters: Draft of implements and its measurement. Field capacity – theoretical, actual and field efficiency. Solved problems on tillage performance parameters. **Cost of cultivation:** Method of cost estimation, fixed cost and variable cost. Solved problemsrelated to cost of cultivation. **Forces acting upon tillage implements**: Mould board plough, disc plough and disc harrow- Solved problems on force analysis.	**equipments**: Weeder – manual and powered, main components and their functional requirement. **Introduction to sowing, planting & transplanting equipment:** Study of working ofseed drills, no-till drills, happy seeder and strip-till drills. Brief description and working of planters. Study of types of furrow openers and metering systems in drills and planters. Calibration of seed-drills/ planters. Adjustments during operation. Introduction to plant protection equipment – sprayers and dusters. **Classification of sprayers.** Types of nozzles. Calculations for calibration of sprayers and chemical application rates.
		UNIT-IV **Sowing**: Definition, sowing methods; Seed cum fertilizer drill-types, components, different types of seed and fertilizer metering mechanisms, different types of furrow openers. Calibrationof Seed cum fertilizer drills. Solved problems related to seeding and calibration of seed cum fertilizer drill. **Transplanting**: Definition, rice transplanter and vegetable transplanter, types and their working principle; Solved problems.	**UNIT-IV:** **Study ofharvesting operation** – methods and terminology. Study of Reapers, Mowers and windrowers – types, working and adjustments. Introduction to threshing systems – manual and mechanical systems. Types of threshing drums and their applications. Types of threshers-tangential and axial, factors affecting thresher performance. Chaff cutters and capacity calculations.
		UNIT-V **Plant protection equipment:** Objectives and uses, types of sprayers and dusters. Sprayercomponents and types of nozzles. Sprayer performance and calibration. **Weeding and Intercultural operations**: Definition, types of weeding equipment- manual, mechanical and flame weeding; Equipment for plant thinning. **Earth moving equipment**: Terminology, Earth moving equipment, shovels, jointers, bulldozers, loaders and Trenchers	**Unit - V** Study of grain combines (Wheat and Paddy) - Combine terminology, Computation of combine losses, study of combine troubleshooting. Study of Root crop diggers – potato and groundnut. Cotton harvesting mechanisms, study of cotton pickers and strippers. Introductionto vegetables and fruit harvesting equipment and tools.

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AGRICULTURAL MACHINERY AND EQUIPMENT LAB

VI Semester
Course Code: 191AG6L11

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0	0	3	1.5

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1: Explain the different types equipments for tillage operations.
CO 2: Measure draft, field capacity and efficiency of various farm implements.
CO 3: Determine the different parameters for different tillage implements.
CO 4: Demonstrate working principles of various harvesting and threshing machinery.
CO 5: Explain the constructional details and working of different harvesting and threshing method for different crops and fruits.

Mapping of course outcomes with program outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	1	-	-	-	-	-	-	1	-
CO3	3	-	2	-	1	-	-	-	-	-	-	1
CO4	3	-	-	-	-	-	-	-	-	-	2	-
CO5	3	1	-	2	2	-	-	-	-	-	-	-

Mapping of course outcomes with program Specific Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3
CO1	1	-	-
CO2	2	-	-
CO3	2	-	-
CO4	3	-	-
CO5	3	-	-

List of Experiments:

1. Introduction to various farm machines.
2. Construction details, adjustments and working of M.B. plough, Disc plough and Disc harrow and secondary tillage tools.
3. Implement performance for different implements under different soilconditions (Atleast two machines).
4. Tractor performance under different soil conditions.
5. Working of seed-cum-fertilizer drills, planters and their calibration in field.
6. Construction and working of rotavators and other rotary tillers, measurementof speed & working width.
7. Construction and Working of rice and crop transplanter for potato, sugarcane, cotton etc., and their field operation patterns.
8. To study weeding equipment and their use.
9. Study of sprayers and dusters, measurement of nozzle discharge, field capacity etc.
10. To study the various types of mowers, constructional details, materials and working.

11. To study the various types of reaper, constructional details, materials used, working and performance.
12. Familiarization with various Farm machines related to harvesting, threshing, root harvesting, combine etc. (Groundnut diggers, Potato harvesters etc.)

List of Augmented Experiments: (Weeks 13 – Week 16)
(Any two of the following experiments can be performed)

1. To study about testing and evaluation of farm implements.
2. To study the construction details of brush cutter.
3. To study balers construction in detail.
4. To study the various types of forage harvesters, constructional details, materials used and working.

Reference Books:

1. Farm Machinery, Stone A A 1958. John wiley and sons, New York.
2. Farm Machinery and Equipment. Smith H.P. 1971. Tata McGraw-Hills Publishing Co.,Ltd., New Delhi.
3. Testing and Evaluation of Agricultural Machinery. Mehta M.L., Verma S.R. Misra S.K. and Sharma V.K. Daya Publishing House, New Delhi.
4. Farm Machinery and Equipment, Smith H P 1971. Tata McGraw Hill Publishing Co.Ltd., New Delhi.

Web Links:

1. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=2262
2. http://www.hillagric.ac.in/edu/coa/agengg/lecture/243/agriengg-243.htm
3. http://www.agrimoon.com/farm-power-and-machinery-icar-ecourse-pdf-book/

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Program Name : M.Tech. in Structural Engineering

Academic Year	Total Number of Courses	Number of Courses Revised	% of Revision
2021-22	66	2	3.03
2020-21	66	32	48.08
2019-20	36	20	55.55
2018-19	27	4	14.81
2017-18	27	4	14.81

Program Coordinator

Head of the Department

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Dept. of Civil Engineering
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Program Name : M.Tech. in Structural Engineering

Syllabus Revision for the Academic Year 2021-2022				
S.No	**Semester**	**Course Code**	**Course Name**	**% of content revised for the existing year**
1	I	192ST1T01	Theory of Elasticity	0
2	I	192ST1T02	Structural dynamics	0
3	I	192ST1T03	Advanced Concrete Technology	0
4	I	1925T1E03	Design of RCC Foundations	0
5	I	1925T1E01	Matrix Analysis of Structures	0
6	I	1925T1E02	Analytical & Numerical Method for Structural Engineering	0
7	I	1925T1E05	Repair & Rehabilitation of Structures	0
8	I	1925T1E04	Bridge Engineering	20
9	I	1925T1E06	Advanced Reinofced Concrete Design	0
10	I	1925T1L01	Advanced Concrete Technology Laboratory	0
11	I	1925T1L02	Advanced Structural Engineering Laboratory	0
12	II	192ST2T04	Finite Element Methods in Structural Engineering	0
13	II	192ST2T05	Theory of Plates and Shells	0
14	II	1925T2E07	Stability of Structures	0
15	II	1925T2E08	Advanced Steel Design	0
16	II	1925T2E09	Analysis of offshore Structures	0
17	II	1925T2E10	Earthquake Restant Design of Buildings	0
18	II	1925T2E11	Precast and Prefabricated Structures	0
19	II	1925T2E12	Earth Retaining Structures	0
20	II	192ST2L03	Computer Aided Design Laboratory	0

21	II	192ST2L04	Structural Design Laboratory	0
22	II	192ST2P01	Mini Project With Seminar	0
23	I/II	192MC1A01/192MC2A01	English for Research Paper Writing	0
24	I/II	192MC1A02/192MC2A02	Disaster Management	0
25	I/II	192MC1A03/192MC2A03	Sanskrit for Technical Knowledge	0
26	I/II	192MC1A04/192MC2A04	Value Education	0
27	I/II	192MC1A05/192MC2A05	Constitution of India	0
28	I/II	192MC1A06/192MC2A06	Pedagogy Studies	0
29	I/II	192MC1A07/192MC2A07	Stress Management by Yoga	0
30	I/II	192MC1A08/192MC2A08	Personality Development through Life Enlightenment Skills	0
31	I/II	192MC1A09/192MC2A09	Soft Skills	0
32	3	192ST3E13	Design of Pre-stressed Concrete structures	0
33	3	192ST3E14	Structural Health Monitoring	0
34	3	192ST3E15	Industrial Structures	20
35	3	19STMOOC1	MOOCS-I*	0
36	3	---	MOOCs-II #	0
37	3	192PD3O01	Renewable Energy Technologies	0
38	3	192PD3O02	Hybrid Electric Vehicles	0
39	3	192PD3O03	Energy Audit and conservation Management	0
40	3	192PD3O04	Neural Networks and Fuzzy Logic	0
41	3	192PD3O05	Industrial Safety	0
42	3	192PD3O06	Composite Materials	0
43	3	192TE3O01	Energy Systems	0
44	3	192TE3O02	Fuels and Combustion	0
45	3	192TE3O04	IC Engines	0
46	3	192TE3O05	Automotive Technology	0

47	3	192ES3O01	Embedded System Design	0
48	3	192ES3O02	Digital System Design	0
49	3	192ES3O03	Programming Languages for Embedded System	0
50	3	192ES3O04	Sensors & Actuators	0
51	3	192VD3O01	Physical Design Automation	0
52	3	192VD3O02	VLSI Technology	0
53	3	192VD3O03	Nano-electronics	0
54	3	192CS3O01	Python Programming (CSE)	0
55	3	192CS3O02	Principles of Cyber Security	0
56	3	192CS3O03	Internet of Things	0
57	3	192CS3O04	Machine Learning	0
58	3	192CS3O05	Artificial Intelligence	0
59	3	192CS3O06	Deep Learning	0
60	3	192PE3O01	Introduction to Petroleum Engineering	0
61	3	192PE3O02	Process Intensification	0
62	3	192PE3O03	Fundamentals of Liquified Natural Gas	0
63	3	192PE3O04	Subsea Engineering	0
64	3	192PE3O06	HSE in Petroleum Industry	0
65	3	192ST3P02	Dissertation-I/ Industrial Project	0
66	4	192ST4P03	Dissertation – II	0
Total number of courses in the academic year 2021-2022 .				= 66
Number of courses having revision in syllabus content >/= 20% in the academic year 2021-2022				= 02
Percentage of syllabus revision carried out in the academic year 2021-2022 = (02/66)*100				= 3.03%

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Head of the Department

PROGRAM STRUCTURE

I SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
192ST1T01	Theory of Elasticity	PCC	3	0	0	3	3
192ST1T02	Structural Dynamics	PCC	3	0	0	3	3
192ST1T03	Advanced Concrete Technology	PCC	2	0	0	2	2
---	Professional Elective-1	PEC	3	0	0	3	3
---	Professional Elective-2	PEC	3	0	0	3	3
192ST1L01	Advanced Concrete Technology Laboratory	PCC	2	0	4	6	2
192ST1L02	Advanced Structural Engineering Laboratory	PCC	0	0	4	4	2
---	Audit Course-1	MC	2	0	0	0	0
		TOTAL	**18**	**0**	**8**	**24**	**18**

II SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
192ST2T04	Finite Element Methods in Structural Engineering	PCC	3	0	0	3	3
192ST2T05	Theory of Plates and Shells	PCC	3	0	0	3	3
---	Professional Elective-III	PEC	3	0	0	3	3
---	Professional Elective-IV	PEC	3	0	0	3	3
192ST2L03	Computer Aided Design Laboratory	PCC	0	0	4	4	2
192ST2L04	Structural Design laboratory	PCC	0	0	4	4	2
192ST2P01	Mini Project With Seminar	PROJ	0	0	4	4	2
---	Audit Course-2	MC	2	0	0	2	0
		TOTAL	**14**	**0**	**12**	**26**	**18**

III SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
---	Professional Elective-V	PEC	3	0	0	3	3
---	Open Elective	OEC	3	0	0	3	3
192ST3P02	Dissertation-I/ Industrial Project	PROJ	0	0	20	20	0
		TOTAL	**6**	**2**	**20**	**26**	**6**

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IV SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
192ST4P03	Dissertation – II	PROJ	0	0	32	32	26
		TOTAL	**0**	**0**	**32**	**32**	**26**

BSC: Basic Sciences Courses; HSMC: Humanities and Social Sciences including Management Courses; PCC: Professional Core Courses; PEC: Professional Elective Courses; OEC: Open Elective Courses; MC: Mandatory Courses; PROJ: Project.

Audit Course-1 & Audit Course-2 has to be chosen from the following list of courses.

S.No	Course Code		Name of the Course
	I Semester	II Semester	
01	192MC1A01	192MC2A01	English for Research Paper Writing
02	192MC1A02	192MC2A02	Disaster Management
03	192MC1A03	192MC2A03	Sanskrit for Technical Knowledge
04	192MC1A04	192MC2A04	Value Education
05	192MC1A05	192MC2A05	Constitution of India
06	192MC1A06	192MC2A06	Pedagogy Studies
07	192MC1A07	192MC2A07	Stress Management by Yoga
08	192MC1A08	192MC2A08	Personality Development through Life Enlightenment Skills
09	192MC1A09	192MC2A09	Soft Skills

Professional Elective – I (I Semester)

S.No	Course Code	Name of the Course
1	192ST1E01	Matrix Analysis of Structures
2	192ST1E02	Analytical & Numerical Metho for Structural Engineering
3	192ST1E03	Design of RCC Foundations

Professional Elective – II (I Semester)

S.No	Course Code	Name of the Course
1	192ST1E04	Bridge Engineering
2	192ST1E05	Repair and Rehabilitation of Structures
3	192ST1E06	Advanced Reinforced Concrete Design

Professional Elective – III (II Semester)

S.No	Course Code	Name of the Course
1	192ST2E07	Stability of Structures
2	192ST2E08	Advanced Steel Design
3	192ST2E09	Analysis of Offshore Structures

Professional Elective – IV (II Semester)

S.No	Course Code	Name of the Course
1	192ST2E10	Earthquake Resistant Design of Buildings
2	192ST2E11	Precast and Prefabricated Structures
3	192ST2E12	Earth Retaining Structures

Professional Elective – V (III Semester)

S.No	Course Code	Name of the Course
1	192ST3E13	Design of Pre-stressed Concrete structures
2	192ST3E14	Structural Health Monitoring
3	192ST3E15	Industrial Structures
4	19STMOOC1	MOOCS-I*

Open Elective (III Semester)

S.No	Course Code	Name of the Course
1	---	MOOCs-II #
2	---	Courses offered by other departments in the college

***MOOCS- I:** A student should select a 12 weeks course which is not opted/ studied earlier.

 # MOOCS- II: A student should select a 12 weeks course in Engineering/ Management/ Mathematics offered by other than parent department.

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Open Elective – Courses offered by Departments

S. No	Course Code	Name of the Course	Not offered to the students of the following M. Tech Specializations	Offered by Dept.
1.	192ST3O01	Repair & Rehabilitation of Structures	ST	CE
2.	192ST3O02	Green Building Systems	ST	CE
3.	192ST3O03	Basic Concrete Technology	ST	CE
4.	192ST3O04	Basic Foundation Engineering	ST	CE
5.	192PD3O01	Renewable Energy Technologies	PED	EEE
6.	192PD3O02	Hybrid Electric Vehicles	PED	EEE
7.	192PD3O03	Energy Audit and conservation Management	PED	EEE
8.	192PD3O04	Neural Networks and Fuzzy Logic	PED	EEE
9.	192PD3O05	Industrial Safety	PED	EEE
10.	192PD3O06	Composite Materials	PED	EEE
11.	192TE3O01	Energy Systems	TE	ME
12.	192TE3O02	Fuels and Combustion	TE	ME
13.	192TE3O03	Green Engineering Technology	ST, TE	ME
14.	192TE3O04	IC Engines	TE	ME
15.	192TE3O05	Automotive Technology	TE	ME
16.	192ES3O01	Embedded System Design	ES	ECE
17.	192ES3O02	Digital System Design	VLSID	ECE
18.	192ES3O03	Programming Languages for Embedded Systems	ES	ECE
19.	192ES3O04	Sensors & Actuators	ES	ECE
20.	192VD3O01	Physical Design Automation	VLSID	ECE
21.	192VD3O02	VLSI Technology	VLSID	ECE
22.	192VD3O03	Nano-electronics	VLSID	ECE
23.	192CS3O01	Python Programming (CSE)	CSE, SE	CSE
24.	192CS3O02	Principles of Cyber Security	CSE	CSE
25.	192CS3O03	Internet of Things	CSE, SE	CSE
26.	192CS3O04	Machine Learning	CSE, SE	CSE
27.	192CS3O05	Artificial Intelligence	SE	IT
28.	192CS3O06	Deep Learning	CSE, SE	IT
29.	192PE3O01	Introduction to Petroleum Engineering	PE	PT
30.	192PE3O02	Process Intensification	PE	PT
31.	192PE3O03	Fundamentals of Liquified Natural Gas	PE	PT
32.	192PE3O04	Subsea Engineering	PE	PT
33.	192PE3O05	Geology	PE, ST	PT
34.	192PE3O06	HSE in Petroleum Industry	PE	PT

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BRIDGE ENGINEERING

(ELECTIVE-II)

I Semester
Course Code: 192ST1E04

L	T	P	C
3	0	0	3

Course Objectives:

- COB 1: To equip the students with the knowledge on different types of Bridges.
- COB 2: To enable the students with the basic concepts of designing bridges of different types.
- COB 3: To familiarize the students with the basic concepts of designing Culverts.
- COB 4: To impart the knowledge on Plate Girder Bridges.
- COB 5: To impart the knowledge on prestressed concrete structures.

Course Outcomes:

At the end of the Course, Student will be able to:

- CO 1 : Explain the basic concepts of bridges.
- CO 2 : Apply various concepts of super structure and substructure in design of bridges.
- CO 3 : Design Culvert, R.C.C T Beam Bridge according to the given specifications.
- CO 4 : Design Plate girder bridges.
- CO 5 : Design of prestressed concrete members.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO 1 (K5)	PO 2 (K4)	PO 3 (K5)	PO 4 (K3)	PO 5 (K3)	PO 6 (K4)	PO 7 (K6)	PO 8 (K2)	PO 9 (K2)	PO 10 (K2)	PO11 (K4)
CO1 (K2)	-	1	-	1	-	-	-	-	-	-	-
CO2 (K3)	1	2	1	3	-	-	-	-	-	-	-
CO3 (K3)	1	2	1	3	-	-	-	-	-	-	-
CO4 (K3)	1	2	1	3	-	-	-	-	-	-	-
CO5 (K3)	1	2	1	3	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1 (K4)	PSO 2 (K6)	PSO 3 (K3)
CO1 (K2)	1	-	-
CO2 (K3)	2	-	-
CO3 (K3)	2	-	-
CO4 (K3)	2	-	-
CO5 (K3)	2	-	-

UNIT–I:

Concrete bridges:

Introduction-Types of Bridges-Economic span Length –Types of loading-Dead load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loads- Longitudinal forces-Seismic loads- Frictional resistance of expansion bearings- Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.

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UNIT–II:

Pigeaud's method:

Design of longitudinal girders-Guyon-Messonet method- Hendry Jaegar method-Courbon's theory. (Ref: IRC-21), voided slabs, Super Structure: Slab bridge- Wheel load on slab- effective width method- slabs supported on two edges- cantilever slabs-dispersion length- Design of interior panel of slab- T-Beam bridges.

UNIT–III:

Box culverts:

Single Cell Box Culvert – Design Loads, Design Moments, Shears and Thrusts. Design of Critical sections.

UNIT–IV:

Plate girder bridges: Elements of plate girder and their design-web flange-intermediate stiffeners-vertical stiffeners-bearing stiffener-design problem.

UNIT–V:

Design of Prestressed Concrete Bridge

Flexural and Torsional parameters - Courbon's Theory - Distribution Coefficient by exact analysis - Design of girder section - maximum and minimum prestressing forces - Eccentricity - Live load and dead load shear forces - Cable Zone in Girder - Check for stresses at various sections - Check for diagonal tension - Diaphragms - End Block -Short term deflections

Text Books:

1. Design of Bridges by N. Krishna Raju CBS Publishers and Distributors.
2. Design of Concrete Bridges- M.G. Aswini, V.N. Vazirani, M.M Ratwani, Khanna Publishers.
3. Essentials of Bridge Engineering-Jhonson Victor D, 7e, Oxford IBH Publications.

Reference Books:

1. Bridge Deck Behavior- E.C. Hambly 2e- CRC Press.
2. Concrete Bridge Design and Practice- V.K. Raina, Tata McGraw- Hill Publishing Company Limited.
3. Bridge Engineering by S. Ponnuswamy, Mc Grawhill Publications.
4. IRC 6- 2016 Standard Specifications and Code of Practice for Road bridges.
5. IRC 112-2011 Code of Practice for Concrete Road Bridge.

Web Links:

1. https://www.nptel.ac.in/courses/105105165/
2. http://www.engineeringenotes.com/civil-engineering/culvert/culvert-types-design-principles-and-parameters-civil-engineering/39613

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INDUSTRIAL STRUCTURES

(ELECTIVE – V)

III Semester | **L T P C**
Course Code: 192ST3E15 | **3 0 0 3**

	L	T	P	C
III Semester				
Course Code: 192ST3E15	3	0	0	3

Course Objectives:

COB 1: To make the students with necessary knowledge on planning and requirements of industrial structures.
COB 2: To enable the students to learn the design of industrial structures.
COB 3: To introduce the concepts of pre-engineered buildings
COB 4: To impart knowledge on various elements of power plant structures.
COB 5: To equip the students to learn about auxiliary structures.

Course Outcomes:

At the end of the Course, Student will be able to:

CO 1: Plan the functional requirements of structural systems for various industries.
CO 2: Get an idea about the materials used and design of industrial structural elements.
CO 3: Design the pre-engineered buildings.
CO 4: Realize the basic concepts and design of power plant structures.
CO 5: Design of RCC and steel chimney structures.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO 1 (K5)	PO 2 (K4)	PO 3 (K5)	PO 4 (K3)	PO 5 (K3)	PO 6 (K4)	PO 7 (K6)	PO 8 (K2)	PO 9 (K2)	PO 10 (K2)	PO 11 (K4)
CO1 (K2)	-	-	-	-	-	-	-	-	-	-	-
CO2 (K4)	2	-	-	-	-	-	-	-	-	-	-
CO3 (K4)	2	3	-	-	-	-	1	-	-	-	-
CO4 (K4)	2	3	-	-	-	-	1	-	-	-	-
CO5 (K4)	2	3	-	-	-	-	1	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K4)	PSO 2(K6)	PSO 3(K3)
CO1 (K2)	1	-	-
CO2 (K4)	3	1	-
CO3 (K4)	3	1	-
CO4 (K4)	3	1	-
CO5 (K4)	3	1	-

UNIT-I

Planning and functional requirements- classification of industries and industrial structures-planning for layout- requirements regarding lighting ventilation and fire safety-protection against noise and vibrations.

UNIT-II

Industrial buildings- roofs for industrial buildings (Steel) - design of gantry girder- design of corbels and nibs- machine foundations.

UNIT –III

Design of Pre-Engineered Buildings.

UNIT-IV

Power plant structures- Bunkers and silos- chimney and cooling towers-Nuclearcontainment Structures. Types of power plants - Design of turbo generator foundation - Raw material handling systems - Conveyors (Belt and Pipe conveyors) - Stacking and storage mechanisms - Containment structures.

UNIT-V

Power transmission structures- transmission line towers- tower foundations-testingtowers.

Auxiliary Structures: Intro to Wind load calculations - Design of steel and RCC Chimneys - Bunkers and silos - Flat and conical bottoms.

Text Books:

1. Handbook on Machine Foundations by P. Srinivasulu and C. V. Vaidyanathan, Structural Engineering Research Center.
2. Tall Chimneys- Design and Construction by S. N. Manohar Tata Mc Grawhill Publishing Company.

Reference Books:

1. Transmission Line Structures by S. S. Murthy and A. R. Santakumar McGraw Hill.
2. SP 32: 1986, Handbook on functional requirements of Industrial buildings.
3. Design of steel structures by N. Subramanian.

Web Links:

1. https://www.electrical4u.com/electrical-transmission-tower-types-and-design/
2. https://civildigital.com/pre-engineered-buildings-peb-components-advantages-design-methodology/
3. https://www.schemmer.com/what-are-pre-engineered-buildings

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Department of Civil Engineering

Syllabus revision Index for the Academic Year 2021-2022M.TechStructural Engineering

S.No	Name of the course	Percentage of syllabus change
1	IndustrialStructures	20
2	Bridge Engineering	20

Department of Civil Engineering

1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Bridge Engineering	Bridge Engineering
Course Code	1925T1E04	1925T1E04
Syllabus	UNIT–I: Concrete bridges: Introduction-Types of Bridges-Economic span Length –Types of loading-Dead load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loadsLongitudinal forces-Seismic loads- Frictional resistance of expansion bearingsSecondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.	UNIT–I: Concrete bridges: Introduction-Types of Bridges-Economic span Length –Types of loading-Dead load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loadsLongitudinal forces-Seismic loads- Frictional resistance of expansion bearingsSecondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.
	UNIT–II: Pigeaud's method: Design of longitudinal girders-Guyon-Messonet method-Hendry Jaegar method-Courbon's theory. (Ref: IRC-21), voided slabs, Super Structure: Slab bridge- Wheel load on slab- effective width method-slabs supported on two edges-cantilever slabs- dispersion length-Design of interior panel of slab-T-Beam bridges	UNIT–II: Pigeaud's method: Design of longitudinal girders-Guyon-Messonet method- Hendry Jaegar method-Courbon's theory. (Ref: IRC-21), voided slabs, Super Structure: Slab bridge- Wheel load on slab-effective width method- slabs supported on two edges- cantilever slabs-dispersion length- Design of interior panel of slab- T-Beam bridges
	UNIT–III: Box culverts: Single Cell Box Culvert – Design Loads, Design Moments, Shears and Thrusts. Design of Critical sections.	UNIT–III: Box culverts: Single Cell Box Culvert – Design Loads, Design Moments, Shears and Thrusts. Design of Critical sections.
	UNIT–IV: Plate girder bridges: Elements of plate girder and their design-web flange-intermediate stiffeners-vertical stiffeners-bearing stiffener-design problem.	UNIT–IV: Plate girder bridges: Elements of plate girder and their design-web flange-intermediate stiffeners-vertical stiffeners-bearing stiffener-design problem.

	UNIT–V: Sub structure: Abutments- Stability analysis of abutments- piers- loads on piers – Analysis of piers- Design problem(Ref: IRC-13, IRC-21, IRC-78)- Pipe culvert- Flow pattern in pipe culvers- culvert alignment-culvert entrance structure- Hydraulic design and structural design of pipe culverts- reinforcements in pipes.(Ref: IRC: SP-13)	UNIT–V: Design of Prestressed Concrete Bridge Flexural and Torsional parameters - Courbon's Theory - Distribution Coefficient by exact analysis - Design of girder section - maximum and minimum prestressing forces - Eccentricity - Live load and dead load shear forces - Cable Zone in Girder - Check for stresses at various sections - Check for diagonal tension - Diaphragms - End Block - Short term deflections

Signature of the course coordinator

Signature of the HOD

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	INDUSTRIAL STRUCTURES	INDUSTRIAL STRUCTURES
Course Code	192ST3E15	192ST3E15
	UNIT-I: Planningandfunctionalrequirements-classificationofindustriesandindustrialstructures-planningforlayout-requirementsregardinglightingventilationandfiresafety-protectionagainst noise and vibrations	UNIT-I: Planningandfunctionalrequirements-classificationofindustriesandindustrialstructures-planningforlayout-requirementsregardinglightingventilationandfiresafety-protectionagainst noise and vibrations
	UNIT-II: Industrialbuildings-roofsforindustrialbuildings(Steel)-designofgantrygirder-designofcorbels andnibs-machine foundations	UNIT-II: Industrialbuildings-roofsforindustrialbuildings(Steel)-designofgantrygirder-designofcorbels andnibs-machine foundations
	UNIT–III: DesignofPre-EngineeredBuildings.	UNIT–III: DesignofPre-EngineeredBuildings.
Syllabus	UNIT-IV:Powerplantstructures-Bunkersandsilos-chimneyandcoolingtowers-NuclearcontainmentStructures	UNIT-IV: Powerplantstructures-Bunkersandsilos-chimneyandcoolingtowers-NuclearcontainmentStructures Types of power plants - Design of turbo generator foundation - Raw material handling systems - Conveyors (Belt and Pipe conveyors) - Stacking and storage mechanisms - Containment structures.

	UNIT-V: Powertransmissionstructures-transmissionlinetowers-towerfoundations-testingtowers.	UNIT-V: Powertransmissionstructures-transmissionlinetowers-towerfoundations-testingtowers.Auxiliary Structures: Intro to Wind load calculations - Design of steel and RCC Chimneys - Bunkers and silos - Flat and conical bottoms.

Signature of the course coordinator

Signature of the HOD

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Program Name : M.Tech. in Power Electronics and Drives

Syllabus Revision for the Academic Year 2021-2022				
S.No	Semester	Course Code	Course Name	% of content revised for the existing year
1	I	192PD1T01	Electrical Machine Modeling and Analysis	0
2	I	192PD1T02	Analysis of Power Electronic Converters	0
3	I	192PD1E01	Modern Control Theory	0
4	I	192PD1E02	Power Quality and Custom Power Devices	0
5	I	192PD1E03	Programmable Logic Controllers & Applications	20
6	I	192PD1E04	Artificial Intelligence Techniques	80
7	I	192PD1E05	Renewable Energy Technologies	0
8	I	192PD1E06	HVDC Transmission and Flexible AC Transmission Syst	0
9	I	192HS1T01	Research Methodology and IPR	0
10	I	192PD1L01	Power Electronics Simulation Laboratory	0
11	I	192PD1L02	Power Converters Laboratory	0
12	I / II	IC1A01 19MC2	English for Research Paper Writing	0
13	I / II	C1A02 19MC2	Disaster Management	0
14	I / II	IC1A03 19MC2	Sanskrit for Technical Knowledge	0
15	I / II	IC1A04 19MC2	Value Education	0
16	I / II	IC1A05 19MC2	Constitution of India	0
17	I / II	IC1A06 19MC2	Pedagogy Studies	0
18	I / II	IC1A07 19MC2	Stress Management by Yoga	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
19	I / II	19MC1A08 19MC2A08	Personality Development through Life Enlightenment Ski	0
20	I / II	19MC1A09 19MC2A09	Soft Skills	0
21	II	192PD2T03	Switched Mode Power Conversion	0
22	II	192PD2T04	Power Electronic Control of Electrical Drives	0
23	II	192PD2E07	Control & Integration of Renewable Energy Systems	0
24	II	192PD2E08	Hybrid Electric Vehicles	0
25	II	192PD2E09	Digital Control Systems	20
26	II	192PD2E10	Advanced Digital Signal Processing	20
27	II	192PD2E11	Applications of Power Converters	0
28	II	192PD2E12	Microcontrollers	0
29	II	192PD2L03	Electric Drives Simulation Laboratory	0
30	II	192PD2L04	Electric Drives Laboratory	0
31	II	192PD2P01	Mini Project with Seminar	0
32	III	192PD3P02	Dissertation I/Industrial Project	0
33	III	192PD3E13	Digital Signal Processing Controlled Drives	0
34	III	192PD3E14	Smart Grid Technologies	0
35	III	192PD3E15	Modeling & Simulation of Power Electronic Systems	0
36	III	19ST3O01	Repair and Rehabilitation of Structures	0
37	III	19ST3O02	Green Building Systems	0
38	III	19ST3O03	Basic Concrete Technology	0
39	III	19ST3O04	Basic Foundation Engineering	0
40	III	19STE3O01	Fuels and Combustion	0
41	III	19STE3O02	IC Engines	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
42	III	19STE3O03	Automotive Technology	0
43	III	19STE3O04	Embedded System Design	0
44	III	19STE3O05	Digital System Design	0
45	III	19ES3O01	Embedded System Design	0
46	III	19ES3O02	Digital System Design	0
47	III	19ES3O03	Programming Languages for Embedded Systems	0
48	III	19ES3O04	Sensors and Actuators	0
49	III	19VD3O01	Physical Design Automation	0
50	III	19VD3O02	VLSI Technology	0
51	III	19VD3O03	Nano-electronics	0
52	III	19CS3O01	Python Programming (CSE)	0
53	III	19CS3O02	Principles of Cyber Security	0
54	III	19CS3O03	Internet of Things	0
55	III	19CS3O04	Machine Learning	0
56	III	19CS3O05	Artificial Intelligence	0
57	III	19CS3O06	Deep Learning	0
58	III	19PE3O01	Introduction to Petroleum Engineering	0
59	III	19PE3O02	Process Intensification	0
60	III	19PE3O03	Fundamentals of Liquefied Natural Gas	0
61	III	19PE3O04	Subsea Engineering	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
62	III	19PE3O05	Geology	0
63	III	19PE3O06	HSE in Petroleum Industry	0
64	IV	192PD4P03	Dissertation II	0

Total number of courses in the academic year 2021-2022		= 64
Number of courses having revision in syllabus content >/= 20% in the academic year 2021-2022		= 4
Percentage of syllabus revision carried out in the academic year 2021-22 =	(4/64)*100	= 6.12%

Rome

Program Coordinator

Head of the Department

Head of The Department

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PROGRAM STRUCTURE

I SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
192PD1T01	Electrical Machine Modeling and Analysis	PCC	3	0	0	3	3
192PD1T02	Analysis of Power Electronic Converters	PCC	3	0	0	3	3
----	Professional Elective – I	PEC	3	0	0	3	3
----	Professional Elective – II	PEC	3	0	0	3	3
192HS1T01	Research Methodology and IPR	HSMC	2	0	0	2	2
192PD1L01	Power Electronics Simulation Laboratory	PCC	0	0	4	4	2
192PD1L02	Power Converters Laboratory	PCC	0	0	4	4	2
----	Audit Course – 1		2	0	0	2	0
TOTAL			**16**	**0**	**08**	**24**	**18**

Professional Elective – I (I Semester)	
Course Code	**Name of the Course**
192PD1E01	Modern Control Theory
192PD1E02	Power Quality and Custom Power Devices
192PD1E03	Programmable Logic Controllers & Applications

Professional Elective – II (I Semester)		
S.No	**Course Code**	**Name of the Course**
1	192PD1E04	Artificial Intelligence Techniques
2	192PD1E05	Renewable Energy Technologies
3	192PD1E06	HVDC Transmission and Flexible AC Transmission Systems

S.No	Course Code		Name of the Course
	I Semester	II Semester	
01	192MC1A01	192MC2A01	English for Research Paper Writing
02	192MC1A02	192MC2A02	Disaster Management
03	192MC1A03	192MC2A03	Sanskrit for Technical Knowledge
04	192MC1A04	192MC2A04	Value Education
05	192MC1A05	192MC2A05	Constitution of India
06	192MC1A06	192MC2A06	Pedagogy Studies
07	192MC1A07	192MC2A07	Stress Management by Yoga
08	192MC1A08	192MC2A08	Personality Development through Life Enlightenment Skills
09	192MC1A09	192MC2A09	Soft Skills

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II SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
192PD2T03	Switched Mode Power Conversion	PCC	3	0	0	3	3
192PD2T04	Power Electronic Control of Electrical Drives	PCC	3	0	0	3	3
----	Professional Elective – III	PEC	3	0	0	3	3
----	Professional Elective – IV	PEC	3	0	0	3	3
192PD2L03	Electric Drives Simulation Laboratory	PCC	0	0	4	4	2
192PD2L04	Electric Drives Laboratory	PCC	0	0	4	4	2
192PD2P01	Mini Project with Seminar	PROJ	0	0	4	4	2
----	Audit Course – 2	----	2	0	0	2	0
TOTAL			**14**	**0**	**12**	**26**	**18**

Professional Elective – III (II Semester)

Course Code	Name of the Course
192PD2E07	Control & Integration of Renewable Energy Systems
192PD2E08	Hybrid Electric Vehicles
192PD2E09	Digital Control Systems

Professional Elective – IV (II Semester)

Course Code	Name of the Course
192PD2E10	Advanced Digital Signal Processing
192PD2E11	Applications of Power Converters
192PD2E12	Microcontrollers

S.No	Course Code		Name of the Course
	I Semester	II Semester	
01	192MC1A01	192MC2A01	English for Research Paper Writing
02	192MC1A02	192MC2A02	Disaster Management
03	192MC1A03	192MC2A03	Sanskrit for Technical Knowledge
04	192MC1A04	192MC2A04	Value Education
05	192MC1A05	192MC2A05	Constitution of India
06	192MC1A06	192MC2A06	Pedagogy Studies
07	192MC1A07	192MC2A07	Stress Management by Yoga
08	192MC1A08	192MC2A08	Personality Development through Life Enlightenment Skills
09	192MC1A09	192MC2A09	Soft Skills

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III SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	Credits (C)
----	Professional Elective – V	PEC	3	0	0	3	3
----	Open Elective	OEC	3	0	0	3	3
192PD3P02	Dissertation I/ Industrial Project	----	0	0	20	20	0
TOTAL			**6**	**0**	**20**	**26**	**6**

Professional Elective – V (III Semester)	
Course Code	**Name of the Course**
192PD3E13	Digital Signal Processing Controlled Drives
192PD3E14	Smart Grid Technologies
192PD3E15	Modeling & Simulation of Power Electronic Systems
----	MOOCs-I *

Open Elective (III Semester)	
Course Code	**Name of the Course**
---	MOOCs- II #
---	Courses offered by other departments in the college

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Open Elective – Courses offered by Departments

S. No	Course Code	Name of the Course	Not offered to the students of the following M.Tech Specializations	Offered by Dept.
1.	192ST3O01	Repair & Rehabilitation of Structures	ST	CE
2.	192ST3O02	Green Building Systems	ST	CE
3.	192ST3O03	Basic Concrete Technology	ST	CE
4.	192ST3O04	Basic Foundation Engineering	ST	CE
5.	192PD3O01	Renewable Energy Technologies	PED	EEE
6.	192PD3O02	Hybrid Electric Vehicles	PED	EEE
7.	192PD3O03	Energy Audit and conservation Management	PED	EEE
8.	192PD3O04	Neural Networks and Fuzzy Logic	PED	EEE
9.	192PD3O05	Industrial Safety	PED	EEE
10.	192PD3O06	Composite Materials	PED	EEE
11.	192TE3O01	Energy Systems	TE	ME
12.	192TE3O02	Fuels and Combustion	TE	ME
13.	192TE3O03	Green Engineering Technology	ST,TE	ME
14.	192TE3O04	IC Engines	TE	ME
15.	192TE3O05	Automotive Technology	TE	ME
16.	192ES3O01	Embedded System Design	ES	ECE
17.	192ES3O02	Digital System Design	VLSID	ECE
18.	192ES3O03	Programming Languages for Embedded Systems	ES	ECE
19.	192ES3O04	Sensors & Actuators	ES	ECE
20.	192VD3O01	Physical Design Automation	VLSID	ECE
21.	192VD3O02	VLSI Technology	VLSID	ECE
22.	192VD3O03	Nano-electronics	VLSID	ECE
23.	192CS3O01	Python Programming (CSE)	CSE, SE	CSE
24.	192CS3O02	Principles of Cyber Security	CSE	CSE
25.	192CS3O03	Internet of Things	CSE, SE	CSE
26.	192CS3O04	Machine Learning	CSE, SE	CSE
27.	192CS3O05	Artificial Intelligence	SE	IT
28.	192CS3O06	Deep Learning	CSE, SE	IT
29.	192PE3O01	Introduction to Petroleum Engineering	PE	PT
30.	192PE3O02	Process Intensification	PE	PT
31.	192PE3O03	Fundamentals of Liquefied Natural Gas	PE	PT
32.	192PE3O04	Subsea Engineering	PE	PT
33.	192PE3O05	Geology	PE, ST	PT
34.	192PE3O06	HSE in Petroleum Industry	PE	PT

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IV SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
192PD4P03	Dissertation II	PROJ	0	0	32	32	26
		TOTAL	**0**	**0**	**32**	**32**	**26**

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PROGAMMABLE LOGIC CONTROLLERS&APPLICATIONS

I Semester: **L T P C**
Course Code: 192PD1E03 **3 0 0 3**

Course Objectives:
The objectives of the course are

- COB 1: To help the students infer the knowledge on PLC.
- COB 2: To make the students build the knowledge on programming of PLC
- COB 3: To help the students learn different PLC registers and their description
- COB 4: To make the students understand the knowledge on data handling functions of PLC.
- COB 5: To enable the students handle analog signal and converting of A/D in PLC.

Course Outcomes:
At the end of the Course, Student will be able to:

- CO 1 : Explain the PLCs and their I/O modules.
- CO 2 : Develop control algorithms to PLC using ladder logic etc
- CO 3 : Describe effective utilization of PLC registers in different applications
- CO 4 : Illustrate data functions to control of two axis and their axis robots with PLC
- CO 5 : Design PID controller with PLC

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1 (K5)	PO 2 (K4)	PO 3 (K5)	PO 4 (K3)	PO 5 (K3)	PO 6 (K4)	PO 7 (K6)	PO 8 (K2)	PO 9 (K2)	PO 10 (K2)	PO 11 (K4)
CO 1(K2)	-	1	-	-	-	-	-	-	-	-	-
CO 2(K5)	-	-	2	-	-	-	-	-	-	-	-
CO 3(K3)	-	-	3	-	-	-	-	-	-	-	-
CO 4(K3)	-	-	3	-	-	-	-	-	-	-	-
CO 5(K5)	-	-	-	-	-	1	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1 (K3)	PSO 2 (K4)	PSO 3 (K3)
CO1 (K2)	2	1	2
CO2 (K5)	3	3	3
CO3 (K3)	3	-	3
CO4 (K3)	-	2	-
CO5 (K5)	-	-	-

UNIT-I:
PLC Basics: PLC system, I/O modules and interfacing, CPU processor, programming equipment, programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNIT-II:
PLC Programming: Input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation. Digital logic gates, programming in the Boolean algebra system, conversion examples. Ladder diagrams for process control: Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT-III:

PLC Registers: Characteristics of Registers, module addressing, holding registers, input registers, output registers. PLC Functions: Timer functions and Industrial applications, counters, counter function industrial applications, Arithmetic functions, Number comparison functions, number conversion functions.

UNIT-IV:

Data Handling functions: SKIP, Master control Relay, Jump, Move, FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axis and three axis Robots with PLC, Matrix functions.

UNIT-V:

Analog PLC operation: Analog modules and systems, Analog signal processing, multi bit data processing, analog output application examples, PID principles, position indicator with PID control, PID modules, PID tuning, PID functions.

Text Books:

1. ProgrammableLogicControllers-PrincipleandApplicationsbyJohnW.Webband Ronald A. Reiss, Fifth Edition, PHI.
2. Programmable Logic Controllers - Programming Method and Applications by JR. Hackworth and F.D Hackworth Jr. - Pearson, 2004.

Referrence Books:

1. Introduction to ProgrammableLogicControllers-GaryDunning-CengageLearning.
2. ProgrammableLogicControllers -W. Bolton-Elsevierpublisher.

Web links:

1. https://en.wikipedia.org/wiki/Programmable_logic_controller
2. https://www.engineersgarage.com/articles/plc-programmable-logic-controller
3. www.deltaelectronicsindia.com/products/IABU-Programmable-Logic-Controller.html

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ARTIFICIAL INTELLIGENCE TECHNIQUES

I Semester **L T P C**
Course Code: 192PD1E04 **3 0 0 3**

Course Objectives:

COB 1: To help the student have knowledge on concept of neural network.
COB 2: To enable the student understand different types of neural networks and training algorithms.
COB 3: To make the student understand the concept of genetic algorithm and its application in optimization.
COB 4: To make the students have the knowledge on fuzzy logic and design of fuzzy logic controllers.
COB 5: To make the students understand applications of AI Techniques in power electronics and DC drives.

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1: Explain neural networks and analyze different types of neural networks.
CO 2: Design training algorithms for neural networks.
CO 3: Develop algorithms using genetic algorithm for optimization.
CO 4: Analyze and design fuzzy logic systems.
CO 5: Apply AI Techniques in power electronics and DC drives.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO 1 (K5)	PO 2 (K4)	PO 3 (K5)	PO 4 (K3)	PO 5 (K3)	PO 6 (K4)	PO 7 (K6)	PO 8 (K2)	PO 9 (K2)	PO 10 (K2)	PO 11 (K4)
CO1 (K2)	2	-	2	-	-	-	-	-	-	-	-
CO2 (K6)	3	-	-	-	-	-	-	-	-	-	-
CO3 (K6)	2	3	2	-	-	-	-	-	-	-	-
CO4 (K4)	-	3	-	-	-	-	-	-	-	-	-
CO5 (K3)	-	-	-	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1 (K3)	PSO 2 (K4)	PSO 3 (K3)
CO1 (K2)	3	2	3
CO2 (K6)	3	3	3
CO3 (K6)	-	-	-
CO4 (K4)	3	3	-
CO5 (K3)	-	3	-

UNIT–I:
Introduction: Artificial Neural Networks (ANN) – definition and fundamental concepts – Biological neural networks –Artificial neuron – activation functions – setting of weights – typical architectures – biases and thresholds– learning/training laws and algorithms. Perceptron – architectures, ADALINE and MADLINE – linearseparability- XOR function.

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UNIT–II: ANN Paradigms: ADALINE – feed forward networks – Back Propagation algorithm- number of hidden layers – gradient decent algorithm – Radial Basis Function (RBF) network. Kohonen"sself organizing map (SOM), Learning Vector Quantization (LVQ) and its types – Functional Link Networks (FLN) – Bidirectional Associative Memory (BAM) – Hopfield Neural Network.

UNIT–III:

Classical and Fuzzy Sets: Introduction to classical sets- properties, Operations and relations; Fuzzy sets, Membership, Operations, Properties, Fuzzy relations, Cardinalities, Membership functions.

UNIT–IV:

Fuzzy Logic Controller (FLC): Fuzzy logic system components: Fuzzification, Inference engine (development of rule base and decision making system), Defuzzification to crisp sets- Defuzzification methods.

UNIT–V:

Application of AI Techniques: Speed control of DC motors using fuzzy logic –load flow studies using back propagation algorithm, single area and two area load frequency control using fuzzy logic.

Text Books:

1. Introduction to Artificial Neural Systems - **Jacek M. Zuarda**, Jaico Publishing House, 1997.
2. Fuzzy logic with Fuzzy Applications – T.J Ross – McGraw Hill Inc, 1997.

Reference Books

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by S. Rajasekaran and G. A. Vijaya Lakshmi Pai – PHI Publication.
2. Modern power Electronics and AC Drives – B. K. Bose -Prentice Hall, 2002
   Genetic Algorithms- David E Goldberg. Pearson publications.
4. Introduction to Neural Networks using MATLAB 6.0 by S N Sivanandam, S Sumathi,S N Deepa TMGH.
4. Introduction to Fuzzy Logic using MATLAB by S N Sivanandam, S Sumathi,S N Deepa Springer, 2007.

Web Links:

1. https://www.slideshare.net/a11b22c33d44e55/artificial-intelligence-in-power-systems-46360765
2. http://www.iosrjournals.org/iosr-jce/papers/necon/volume-1/B.pdf
3. https://books.google.co.in/books/about/Artificial_Intelligence_Techniques_in_Po.html?id=qQ2uuBhlaXAC

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DIGITAL CONTROL SYSTEMS

(Professional Elective-III)

II Semester **L T P C**

Course Code: 192PD2E09 **3 0 0 3**

Course Objectives:

- COB 1: To enable the students study concepts of digital control systems and theory of z–transformations.
- COB 2: To assist the students to Know the discrete–time systems in state–space model and evaluation of state transition matrix.
- COB 3: To help the students acquire the significance stability of the system using different tests.
- COB 4: To assist the students to learn the concept of State Observers in State feedback systems.
- COB 5: To enable the students to analyze the Quadratic Optimal Control systems and its discretization.

Course Outcomes:

At the end of the Course, Student will be able to:

- CO 1 : Explain the advantages of discrete time control systems and theory of z–transformations.
- CO 2 : Apply the discrete–time systems in state–space model.
- CO 3 : Analyze the significance stability of the system using different tests.
- CO 4 : Illustrate concept of State Observers in State feedback systems.
- CO 5 : Analyze the concept of Quadratic Optimal Control Systems and its discretization.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO 1 (K5)	PO 2 (K4)	PO 3 (K5)	PO 4 (K3)	PO 5 (K3)	PO 6 (K4)	PO 7 (K6)	PO 8 (K2)	PO 9 (K2)	PO 10 (K2)	PO 11 (K4)
CO1 (K1)	1	-	-	-	-	-	-	-	-	-	-
CO2 (K1)	1	-	-	-	-	-	-	-	-	-	-
CO3 (K3)	3	2	1	1	-	-	-	-	-	-	-
CO4 (K4)	1	3	2	2	-	-	-	-	-	-	-
CO5 (K1)	3	-	-	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO / PSO	PSO 1 (K3)	PSO 2 (K4)	PSO 3 (K3)
CO1 (K1)	-	-	1
CO2 (K1)	-	-	-
CO3 (K3)	1	1	-
CO4 (K4)	2	2	-
CO5 (K1)	-	-	1

UNIT–I:

Introduction:

Introduction to analog and digital control systems – Advantages of digital systems – Typical examples– Sample and hold devices – Sampling theorem and data reconstruction-Transfer functions and frequency domain characteristics of zero order hold and first order hold. Review of Z–transforms and Inverse Z– transforms- solving

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differential equations. Mapping between the S–Plane and the Z–Plane – Primary strips and Complementary Strips

UNIT–II:

State space analysis and the concepts of Controllability and observability:

State Space Representation of discrete time systems – State transition matrix properties and evaluation – Solution of state equations- Discretization of continuous-time state equations –controllability and observability – concepts, conditions and tests, Principle of duality.

UNIT–III:

Stability Analysis and Controller Design:

Stability criterion – Modified Routh"s stability criterion and Jury"s stability test, Lyapunov"s stability analysis. Design of state feedback controller through pole placement techniques, Necessary and sufficient conditions, Ackermann"s formula, controller for deadbeat response, control system with reference input, Design of full order observer-reduced order observer.

UNIT–IV:

State Observer:

Necessary and sufficient condition for state observation-Full order state observer- error dynamics – design of prediction observers- Ackermann"s formula-effect of the addition of observer on closed loop system-Current observer- minimum order observer observed – state feedback control system with minimum order observer -control system with reference input.

UNIT–V:

Quadratic Optimal Control Systems:

Quadratic optimal control problems-Solution by minimization method using Lagrange multipliersEvolution of the minimum performance index – discretize quadratic optimal control –Steady state Riccati equations-Lyapunov approaches to the solution of the Steady state quadratic optimal regulator problem and optimal control problem - Quadratic optimal control of a servo system.

Text Books:

1. Discrete–Time Control systems – K. Ogata, Pearson Education/PHI, 2nd Edition.
2. B. C. Kuo, "Digital control systems"- Holt Saunder"s International Edition, 1991.

Reference Books:

1. M. Gopal: Digital control engineering, New Age Int. Ltd., India, 1998.
2. K. Ogata, "Modern control engineering"- PHI, 1991.

Web Links:

1. https://www.inf.ethz.ch/personal/cellier/Lect/DC/Lect_dc_index.html
2. https://www.nptel.ac.in/downloads/108103008/

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ADVANCED DIGITAL SIGNAL PROCESSING

II Semester **L T P C**
Course Code: 192PD2E10 **3 0 0 3**

Course Educational Objectives:

COB 1: o make the student understand the various digital filter structures.
COB 2: To facilitate the students design the FIR and IIR Filters.
COB 3: To help the students know the importance of FFT algorithm for computation of Discrete Fourier Transform.
COB 4: To enable the students analyze the finite word length effects on various filters.
COB 5: To assist the students learn the concepts of power spectrum estimation of periodic and non-periodic signals.

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1 : Describe structure of digital filters.
CO 2 : Design digital filters with different techniques.
CO 3 : Analyze the implementation aspects of signal processing algorithms.
CO 4 : Illustrate the effect of finite word length in signal processing.
CO 5 : Analyze different power spectrum estimation techniques.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO 1 (K5)	PO 2 (K4)	PO 3 (K5)	PO 4 (K3)	PO 5 (K3)	PO 6 (K4)	PO 7 (K6)	PO 8 (K2)	PO 9 (K2)	PO 10 (K2)	PO 11 (K4)
CO1 (K2)	2	1	2	-	-	-	-	-	1	-	-
CO2 (K4)	2	3	3	-	-	-	-	-	1	-	-
CO3 (K3)	1	2	3	2	-	-	-	-	-	-	-
CO4 (K2)	2	3	3	3	1	-	-	1	2	-	-
CO5 (K4)	3	3	3	3	3	-	-	3	3	3	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1 (K3)	PSO 2 (K4)	PSO 3 (K3)
CO1 (K2)	2	1	2
CO2 (K4)	3	-	3
CO3 (K3)	3	2	3
CO4 (K2)	-	3	-
CO5 (K4)	3	3	-

UNIT–I:
Digital Filter Structure:
Block diagram representation-Equivalent Structures-FIR and IIR digital filter Structures All pass Filters-tunable IIR Digital Filters-IIR tapped cascaded Lattice Structures-FIR cascaded Lattice structures-Parallel-Digital Sine-cosine generator-Computational complexity of digital filter structures.

UNIT–II:
Digital filter design:
Preliminary considerations-Bilinear transformation method of IIR filter design of low pass, high pass-band pass, and band stop- IIR digital filters-Spectral transformations of

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IIR filters, FIR filter design-based on windowed Fourier series- design of FIR digital filters with least –mean square- error-constrained least-square design of FIR digital filters.

UNIT–III:

DSP algorithm implementation:

Computation of the discrete Fourier transform- number representation arithmetic operations handling of overflow-tunable digital filters-function approximation.

UNIT–IV:

Analysis of finite Word length effects:

The quantization process and errors- quantization of fixed –point and floating -point Numbers-Analysis of coefficient quantization effects, Analysis of arithmetic round-off errors, dynamic range scaling-signal- to- noise ratio in low -order IIR filters-low-sensitivity digital filters-Reduction of Product round-off errors using error feedback-Limit cycles in IIR digital filters, Round-off errors in FFT Algorithms.

UNIT–V:

Power Spectrum Estimation:

Estimation of spectra from finite duration observations signals – Nonparametric methods for power spectrum estimation – parametric method for power spectrum estimation, estimation of spectral form-finite duration observation of signals-non-parametric methods for power spectrum estimation-Walsh methods-Blackman & torchy method.

Text Books:

1. Digital signal processing-Sanjit K. Mitra-TMH second edition, 2002.
2. Discrete Time Signal Processing – Alan V.Oppenheim, Ronald W.Shafer - PHI-1996 1st edition-9th reprint.

Reference Books:

1. Digital Signal Processing and principles, algorithms and Applications – John G.Proakis -PHI –3rd edition-2002.
2. Digital Signal Processing – S.Salivahanan, A.Vallavaraj, C. Gnanapriya – TMH - 2nd reprint-2001.
3. Theory and Applications of Digital Signal Proceesing-LourensR.Rebinar & Bernold.
4. Digital Filter Analysis and Design-Auntonian-TMH.

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ADITYA ENGINEERING COLLEGE

An Autonomous Institution

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Recognised by UGC under sections 2(f) and 12(B) of UGC Act, 1956

Aditya Nagar, ADB Road, Surampalem - 533437, Near Kakinada, E.G.Dt., Ph:99498 76662

Department of Electrical and Electronics Engineering

(Power Electronics and Drives)

Syllabus revision Index for 2021-2022

S. No	Name of the course	Percentage of syllabus change
1	Programmable Logic Controllers & Applications	20
2	Artificial Intelligence Techniques	80
3	Digital Control Systems	20
4	Advanced Digital Signal Processing	20

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Recognised by UGC under sections 2(f) and 12(B) of UGC Act, 1956
Aditya Nagar, ADB Road, Surampalem - 533437, Near Kakinada, E.G.Dt., Ph:99498 76662

Department of Electrical and Electronics Engineering

1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	**Programmable Logic Controllers & Applications**	**Programmable Logic Controllers & Applications**
Course Code	**192PD1E03**	**192PD1E03**
Syllabus	**UNIT - I: PLC Basics:** PLC system, I/O modules and interfacing, CPU processor, programming equipment, programming formats, construction of PLC ladder diagrams.	**UNIT - I: PLC Basics:** PLC system, I/O modules and interfacing, CPU processor, programming equipment, programming formats, construction of PLC ladder diagrams, devices connected to I/O modules
	UNIT - II: PLC Programming: Input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation. Digital logic gates, programming in the Boolean algebra system, conversion examples. Ladder diagrams for process control: Ladder diagrams and sequence listings, ladder diagram construction.	**UNIT - II: PLC Programming:** Input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation. Digital logic gates, programming in the Boolean algebra system, conversion examples. Ladder diagrams for process control: Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.
	UNIT - III: PLC Registers: Characteristics of Registers, module addressing, holding registers, input registers, output registers. PLC Functions: Timer functions and Industrial applications, counters, counter function industrial applications, Arithmetic functions.	**UNIT - III: PLC Registers:** Characteristics of Registers, module addressing, holding registers, input registers, output registers. PLC Functions: Timer functions and Industrial applications, counters, counter function industrial applications, Arithmetic functions, Number comparison functions, number conversion functions.
	UNIT - IV: Data Handling functions: SKIP, Master control Relay, Jump, Move, FIFO, FAL,	**UNIT - IV: Data Handling functions:** SKIP, Master control Relay, Jump, Move, FIFO, FAL,

	ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axis and three axis Robots with PLC.	ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axis and three axis Robots with PLC, Matrix functions
	UNIT - V: Analog PLC operation: Analog modules and systems, Analog signal processing, multi bit data processing, analog output application examples, PID principles, position indicator with PID control.	**UNIT - V: Analog PLC operation:** Analog modules and systems, Analog signal processing, multi bit data processing, analog output application examples, PID principles, position indicator with PID control., PID modules, PID tuning, PID functions

Course Coordinator

Head of the Department

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	**Artificial Intelligence Techniques**	**Artificial Intelligence Techniques**
Course Code	**192PD1E04**	**192PD1E04**
	UNIT–I: Introduction: Artificial Neural Networks (ANN) – definition and fundamental concepts – Biological neural networks –Artificial neuron – activation functions – setting of weights – typical architectures – biases and thresholds– learning/training laws and algorithms. Perceptron – architectures, ADALINE and MADLINE – linear separability- XOR function	**UNIT – 1: Introduction to Neural Networks** Introduction, Humans and Computers, Biological Neural Networks, Historical development of neural network, Terminology and Topology, Biological and artificial neuron models, Basic learning laws.
Syllabus	**UNIT–II: ANN Paradigms:** ADALINE – feed forward networks – Back Propagation algorithm- number of hidden layers – gradient decent algorithm – Radial Basis Function (RBF) network. Kohonen"s self organizing map (SOM), Learning Vector Quantization (LVQ) and its types – Functional Link Networks (FLN) – Bidirectional Associative Memory (BAM) – Hopfield Neural Network.	**UNIT- 2: Feed Forward Neural Networks** Introduction, Perceptron models: Discrete, continuous and multi-category, Training algorithms: Discrete and Continuous Perceptron Networks, Perceptron convergence theorem, Limitations and applications of the Perceptron model, Generalized delta learning rule, Feedforward recall and error back propagation training-Radial basis function algorithms-Hope field networks
	UNIT–III: Classical and Fuzzy Sets: Introduction to classical sets-properties, Operations and relations; Fuzzy sets, Membership, Operations, Properties, Fuzzy relations, Cardinalities, Membership functions.	**UNIT -3: Genetic algorithms &Modelling**-Introduction-encoding-fitness function-reproduction operators-genetic operators-cross over and mutation-generational cycle-convergence of genetic algorithm
	UNIT–IV: Fuzzy Logic Controller (FLC): Fuzzy logic system components: Fuzzification, Inference	**UNIT – 4: Classical and Fuzzy Sets** Introduction to classical sets - properties, operations and relations;

	engine (development of rule base and decision making system), Defuzzification to crisp sets- Defuzzification methods.	Fuzzy sets, membership, Uncertainty, operations, properties, fuzzy relations, cardinalities, membership functions. Fuzzy Logic System Components- Fuzzification, Membership value assignment, development of rule base and decision making system, defuzzification to crisp sets, defuzzification methods.
	UNIT–V: Application of AI Techniques: Speed control of DC motors using fuzzy logic –load flow studies using back propagation algorithm, single area and two area load frequency control using fuzzy logic.	**UNIT-5: Application of AI Techniques:** Design of PI controller for speed control of DC motor using neural networks and fuzzy logic-PWM Controllers -Selected harmonic elimination PWM- Space vector PWM using neural network.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	**Digital Control Systems**	**Digital Control Systems**
Course Code	**192PD2E09**	**192PD2E09**
Syllabus	**UNIT–I: Introduction:** Introduction to analog and digital control systems – Advantages of digital systems – Typical examples– Sample and hold devices – Sampling theorem and data reconstruction- Transfer functions and frequency domain characteristics of zero order hold and first order hold. Review of Z–transforms and Inverse Z–transforms- solving differential equations. Mapping between the S–Plane and the Z–Plane – Primary strips and Complementary Strips	**UNIT – I: Introduction:** Block Diagram of typical control system- advantages of sampling in control systems – examples of discrete data and digital systems – data conversion and quantization – sample and hold devices – D/A and A/D conversion – sampling theorem – reconstruction of sampled signals – ZOH. Z-transform: Definition and evaluation of Z-transforms – mapping between s-plane and z-plane – inverse z-plane transform – theorems of the Z-transforms –limitations of z-transforms –pulse transfer function –pulse transfer function of ZOH –relation between G(s) and G(z) – signal flow graph method applied to digital systems.
	UNIT–II: State space analysis and the concepts of Controllability and observability: State Space Representation of discrete time systems – State transition matrix properties and evaluation – Solution of state equations- Discretization of continuous- time state equations – controllability and observability – concepts, conditions and tests, Principle of duality.	**UNIT–II: State space analysis and the concepts of Controllability and observability:** State Space Representation of discrete time systems – State transition matrix properties and evaluation – Solution of state equations- Discretization of continuous- time state equations – controllability and observability – concepts, conditions and tests, Principle of duality.
	UNIT–III: Stability Analysis and Controller Design: Stability criterion – Modified Routh"s stability criterion and Jury"s stability	**UNIT–III: Stability Analysis and Controller Design:** Stability criterion – Modified Routh"s stability criterion and Jury"s stability

	test, Lyapunov"s stability analysis. Design of state feedback controller through pole placement techniques, Necessary and sufficient conditions, Ackermann"s formula, controller for deadbeat response, control system with reference input, Design of full order observer-reduced order observer.	test, Lyapunov"s stability analysis. Design of state feedback controller through pole placement techniques, Necessary and sufficient conditions, Ackermann"s formula, controller for deadbeat response, control system with reference input, Design of full order observer-reduced order observer.
	UNIT–IV: State Observer: Necessary and sufficient condition for state observation-Full order state observer- error dynamics – design of prediction observers- Ackermann"s formula-effect of the addition of observer on closed loop system-Current observer- minimum order observer observed – state feedback control system with minimum order observer -control system with reference input.	**UNIT-V: Digital State Observer:** Design of – Full order and reduced order observers. Design by max. Principle: Discrete Euler language equation-discrete maximum principle.
	UNIT–V: Quadratic Optimal Control Systems: Quadratic optimal control problems-Solution by minimization method using Lagrange multipliersEvolution of the minimum performance index – discretize quadratic optimal control – Steady state Riccati equations-Lyapunov approaches to the solution of the Steady state quadratic optimal regulator problem and optimal control problem - Quadratic optimal control of a servo system.	**UNIT–V: Quadratic Optimal Control Systems:** Quadratic optimal control problems-Solution by minimization method using Lagrange multipliersEvolution of the minimum performance index – discretize quadratic optimal control – Steady state Riccati equations-Lyapunov approaches to the solution of the Steady state quadratic optimal regulator problem and optimal control problem - Quadratic optimal control of a servo system.

Course Coordinator

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	**Advanced Digital Signal Processing**	**Advanced Digital Signal Processing**
Course Code	**192PD2E10**	**192PD2E10**
Syllabus	**UNIT–I: Digital Filter Structure:** Block diagram representation-Equivalent Structures-FIR and IIR digital filter Structures All pass Filters-tunable IIR Digital Filters-IIR tapped cascaded Lattice Structures-FIR cascaded Lattice structures-Parallel-Digital Sine-cosine generator-Computational complexity of digital filter structures.	**UNIT–I: Digital Filter Structure:** Block diagram representation-Equivalent Structures-FIR and IIR digital filter Structures All pass Filters-tunable IIR Digital Filters-IIR tapped cascaded Lattice Structures-FIR cascaded Lattice structures-Parallel-Digital Sine-cosine generator-Computational complexity of digital filter structures.
	UNIT–II: Digital filter design: Preliminary considerations-Bilinear transformation method of IIR filter design of low pass, high pass-band pass, and band stop- IIR digital filters-Spectral transformations of IIR filters, FIR filter design-based on windowed Fourier series- design of FIR digital filters with least –mean square- error-constrained least-square design of FIR digital filters.	**UNIT–II: Optimum Filters:** Wiener filters - FIR Wiener filter - discrete Wiener Hopf equation, Applications - filtering, linear prediction. IIR Wiener filter - causal and non-causal filters. Recursive estimators - discrete Kalman filter.
	UNIT–III: DSP algorithm implementation: Computation of the discrete Fourier transform- number representation arithmetic operations handling of overflow-tunable digital filters-function approximation.	**UNIT–III: DSP algorithm implementation:** Computation of the discrete Fourier transform- number representation arithmetic operations handling of overflow-tunable digital filters-function approximation.
	UNIT–IV: Analysis of finite Word length effects: The quantization process and errors- quantization of fixed –point and floating -point Numbers-Analysis of coefficient	**UNIT–IV: Analysis of finite Word length effects:** The quantization process and errors- quantization of fixed –point and floating -point Numbers-Analysis of

	quantization effects, Analysis of arithmetic round-off errors, dynamic range scaling-signal- to- noise ratio in low -order IIR filters-low- sensitivity digital filters-Reduction of Product round-off errors using error feedback- Limit cycles in IIR digital filters, Round-off errors in FFT Algorithms.	coefficient quantization effects, Analysis of arithmetic round-off errors, dynamic range scaling-signal- to- noise ratio in low -order IIR filters-low-sensitivity digital filters-Reduction of Product round-off errors using error feedback- Limit cycles in IIR digital filters, Round-off errors in FFT Algorithms.
	UNIT–V: Power Spectrum Estimation: Estimation of spectra from finite duration observations signals – Nonparametric methods for power spectrum estimation – parametric method for power spectrum estimation, estimation of spectral form-finite duration observation of signals-non- parametric methods for power spectrum estimation-Walsh methods-Blackman & torchy method.	**UNIT–V: Power Spectrum Estimation:** Estimation of spectra from finite duration observations signals – Nonparametric methods for power spectrum estimation – parametric method for power spectrum estimation, estimation of spectral form-finite duration observation of signals-non-parametric methods for power spectrum estimation-Walsh methods-Blackman & torchy method.

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Program Name : M.Tech. in Thermal Engineering

Syllabus Revision for the Academic Year 2021-2022

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
1	I	192TE1T01	Advanced Fluid Mechanics	0
2	I	192TE1T02	Computational Fluid Dynamics	0
3	I	192TE1E01	Advanced IC Engines, Electric and Hybrid Vehicles	0
4	I	192TE1E02	Gas Dynamics	0
5	I	192TE1E03	Cryogenic Engineering	0
6	I	192TE1E04	Advanced Thermodynamics	0
7	I	192TE1E05	Gas Turbines	0
8	I	192TE1E06	Alternative Fuel Technologies	0
9	I	192TE1E07	Energy Conservation and Management	0
10	I	192TE1E08	Theory And Technology of Fuel Cells	0
11	I	192HS1T01	Research Methodology And IPR	0
12	I	192TE1L01	Computational Fluid Dynamics Lab-I	0
13	I	19TE1L02	Thermal Engineering Lab -1	0
14	I	192MC1A01/ 192MC2A01	English for Research Paper Writing	0
15	I	192MC1A02/ 192MC2A02	Disaster Management	0
16	I	192MC1A03/ 192MC2A03	Sanskrit for Technical Knowledge	0
17	I	192MC1A04/ 192MC2A04	Value Education	0
18	I	192MC1A05/ 192MC2A05	Constitution of India	0
19	I	192MC1A06/ 192MC2A06	Pedagogy Studies	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
20	I	192MC1A07/ 192MC2A07	Stress Management By YOGA	0
21	I	192MC1A08/ 192MC2A08	Personality Development Through Life Enlightment Skills	0
22	I	192MC1A09/ 192MC2A09	Soft Skills	0
23	II	192TE2T03	Advanced Heat Transfer	0
24	II	192TE2T04	Thermal Measurements and Process Controls	0
25	II	192TE2E09	Equipment Design for Thermal Systems	0
26	II	192TE2E10	Solar Energy Technologies	0
27	II	192TE2E11	Advanced Power Plant Engineering	0
28	II	192TE2E12	Combustion, Emissions and Environment	0
29	II	192TE2E13	Jet Propulsion and Rocket Engineering	20
30	II	192TE2E14	Automotive Engineering	0
31	II	192TE2E15	Modeling and I.C. Engines	0
32	II	192TE2E16	Renewable Energy Technologies	0
33	II	192TE2L03	Computational Fluid Dynamics Lab-II	0
34	II	192TE2L04	Thermal Engineering Lab -II	0
35	II	192TE2P01	Mini Project with Seminar	0
36	III	192TE3E17	Optimization Techniques and Applications	0
37	III	192TE3E18	Design and Analysis of Experiments	0
38	III	192TE3E19	Convective Heat Transfer	20
39	III	192TE3E20	Waste to Energy	0
40	III	192ST3O01	Repair & Rehabilitation of Structures	0
41	III	192ST3O02	Green Building Systems	0
42	III	192ST3O03	Basic Concrete Technology	0
43	III	192ST3O04	Basic Foundation Engineering	0
44	III	192PD3O01	Renewable Energy Technologies	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
45	III	192PD3O02	Hybrid Electric Vehicles	0
46	III	192PD3O03	Energy Audit and Conservation Management	0
47	III	192PD3O04	Neural Networks and Fuzzy Logic	0
48	III	192PD3O05	Industrial Safety	0
49	III	192PD3O06	Composite Materials	0
50	III	192ES3O01	Embedded System Design	0
51	III	192ES3O02	Digital System Design	0
52	III	192ES3O03	Programming Languages for Embedded Systems	0
53	III	192ES3O04	Sensors & Actuators	0
54	III	192VD3O01	Physical Design Automation	0
55	III	192VD3O02	VLSI Technology	0
56	III	192VD3O03	Nano-Electronics	0
57	III	192CS3O01	Python Programming	0
58	III	192CS3O02	Principles of Cyber Security	0
59	III	192CS3O03	Internet of Things	0
60	III	192CS3O04	Machine Learning	0
61	III	192CS3O05	Artificial Intelligence	0
62	III	192CS3O06	Deep Learning	0
63	III	192PE3O01	Introduction to Petroleum Engineering	0
64	III	192PE3O02	Process Intensification	0
65	III	192PE3O03	Fundamentals of Liquefied Natural Gas	0
66	III	192PE3O04	Subsea Engineering	0
67	III	192PE3O05	Geology	0
68	III	192PE3O06	HSE In Petroleum Industry	0
69	III	192TE3P02	Dissertation I/Industrial Project	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
70	IV	192TE4P03	Dissertation II	0
Total number of courses in the academic year 2021-2022				70
Number of courses having revision in syllabus content >/= 20% in the academic year 2021-2022				2
Percentage of syllabus revision carried out in the academic year 2021-2022 = (2/70)*100				= 2

Program Coordinator

Head of the Department

Head of the Department
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Date: 20-04-2022

Minutes of the VIII meeting of BOS scheduled on 18-04-2022

The VIII meeting of the BOS (Board of Studies) of ME was held on 18-04-2022 at 10:00 AM in the AjivikaConference Hall, Bill Gates Bhavan, AEC. Dr.Bh.Vara Prasad, Chairperson presided over the meeting.

Agenda 8.1:Welcome address by Chairperson.

Prof Bh. Vara Prasad, BOS chairperson invited the distinguished members of BOS to the VIII BOS Meeting.

Agenda 8.2: Ratification of minutes of the previous Board of Studies meeting

The BOS members have ratified the points discussed in the previous Board of Studies meeting held on 28/09/2021.

Agenda 8.3:Discussion on proposed AR 20 B. Tech Program– V, VI, VII & VIII semesters syllabus and ratification of the same

The BOS members approved the AR **20** B. Tech (ME) V,VI,VII&VIIISemesters syllabus after making the following changes in the proposed syllabi.

- Suggested to keep "Theory of Machines", III edition, Pearson Publication by Thomas Bevan and "Theory of Mechanisms and Machines" I edition, Metropolitan Publication by Jagdish Lal as Reference books in Theory of Machines -II subject.
- Suggested to add "Basics of Jet Propulsion and Rocket Engineering" topic in Unit-V of Thermal Engineering-II subject.
- Suggested to replace "Non-traditional" with "advanced machining Processes" and advised to remove "process parameters" of the advanced processes and also suggested to add "Manufacturing Technology- Metal cutting and machine tools by PN Rao, Tata Mc Grawhill as Reference book in Metal cutting and machine tools subject.

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- Suggested to add "Electrical vehicles" topicin AutomobileEngineering of Professional Elective-Iand also advised to introduce Electrical Vehicles as a separate elective subject.
- Suggested to add "introduction about ceramics" in unit-III of composite materials subject in professional Elective-I.
- Suggested to replace "gas turbines" topic with "hydraulic turbines and compressors"influid engineering subject of Professional Elective-I. Also suggested to change the subject title as "Fluid Machinery" instead of "Fluid Engineering".
- Suggested to introduce "Text Book of Mechanical Vibrations" by J.S.Rao and Rao.V. Dukkipati, II edition, 2012, PHI Publications as Reference book in Mechanical Vibrations subject of professional elective
- Suggested to reduce syllabus of "Automobile Engineering" in Open Elective-I.
- Suggested to add "Indian Scenario" topic in IPR (Mandatory Course).
- Suggested to add "Refrigeration and Air Conditioning"byW.F.Stoecker and J.W.Jones, II edition ,2014, Mc.Graw Hill Publicationsas reference book in Refrigeration and Air Conditioning Subject
- Suggested to change title of the subject from "alternate fuels" to "alternative fuels" in professional elective -III
- Suggested to extend "Design for manufacturing and Assembly" topic to real world topics where product based/ Automobile Engineers are looking nowadays in professional elective -III.
- Suggested to add "strain rate analysis and temperature analysis"in Unit-V in "Experimental stress analysis" subjectof professional elective -IV.
- Suggested to introduce "Mechatronics by Hindustan Machine Tools", I edition,2017,Mc. Graw Hill Publicationsin Mechatronics subject.

Agenda 8.4:Discussion on proposed syllabus for courses in V to VII Semester under AR20 Honors and Minor Degree and ratification of the same.

The BOS members approved the V, VI, VII&VIIISemester under AR20 Honors and Minor Degree syllabus after making the following changes in the proposed syllabi.

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- Suggested to keep "Introduction to Robotics", II edition,2008, Mc. Graw Hill Publications by S.K.SAHA as reference book in Robotics-Modelling, Analysis& Control) in Pool-II of B. Tech- Honors.

Agenda 8.5: Discussion on the value-added courses to be offered for students and ratification of the same

The members of BOS ratified the various value-added coursesidentified for the students to be offered and suggested to include topics related to thrust areas.

Agenda 8.6: Discussion on the new courses offered in B. Tech (ME) program and ratification of the same

The Members of BOS noted the new courses offered in the B.Tech (ME) program and ratified the same. The percentage of courses introduced in the academic year 2021-2022 for B.Tech (ME) Program is 12.59%. The list of courses introduced is enclosed as Annexure-I.

Agenda 8.7: Discussion on the percentage of syllabus revision done in the B. Tech (ME) and M. Tech (TE)programs and ratification of the same.

The syllabus revisions were done in B. Tech (ME) and M.Tech (TE) programs based on the stakeholders feedback on the curriculum. The BOS members have approved all the syllabus revisions in B. Tech (ME) and M.Tech (TE) programs. The percentage of courses revised in the academic year2021-2022 for B.Tech (ME) program is 38.58% and M.Tech (TE) program is 2%.The list of courses revised is enclosed as Annexure-II.

Agenda 8.8:Discussion on the courses having focus on employability/entrepreneurship/skill development of B. Tech (ME), M. Tech(TE) Programs and ratification of the same.

The members of BOS ratified the courses having focus on employability/entrepreneurship/skill development in B. Tech (ME) and M.Tech (TE) programmes.

Agenda 8.9: Discussion on B. Tech (ME), M. Tech (T.E) programs in which Choice Based Credit System (CBCS) / Elective Course System (ECS) is being implemented and ratification of the same.

The Members of BOS ratified the Choice Based Credit System (CBCS)/Elective Course System that is being implemented in B. Tech (ME) and M. Tech (TE) programs.

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Agenda 8.10: Analysis of stakeholder'sfeedback on Curriculum.

The BOS chairperson presented the feedback on curriculum from stake holders. The BOS members noted the same and approved the feedback on curriculum. The action taken report is enclosed in Annexure III.

Agenda 8.11: Analysis of results of the odd semesters of the academic year 2021-22

The BOS chairperson presented odd semester pass percentage for the A.Y.2021-2022.The BOS members noted the same.

Agenda 8.12: Analysis of student's feedback in the odd semesters of the academic year 2021-22

BOS Chairperson expressed that the student feedback & action taken report process initiated at end of each semester.

Agenda 8.13: Any other item with the approval of Chairperson

NIL

Agenda 8.14: Scheduling of next Board of Studies meeting.

The next BOS meeting is tentatively scheduled in the month of September,2022.

Agenda 8.15:Vote of Thanks

Prof Bh.Vara Prasad, BOS Chairperson presented the vote of thanks.

BOS Chairperson

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Annexure-I

List of New Courses in the Academic Year 2021-22

S. No	Program	Semester	Course Code	Course Name
1	B. Tech (ME)	III	201SC3L03	Java Programming Lab
2	B. Tech (ME)	IV	201SC4L15	Python Programming Lab
3	B. Tech (ME)	V	191ME5E02	Composite Materials
4	B. Tech (ME)	V	191ME5E06	Organizational Behavior
5	B. Tech (ME)	V	191ME6O01	Renewable Energy Sources
6	B. Tech (ME)	V	191ME6O02	Fundamentals of Mechanical Engineering
7	B. Tech (ME)	V	191ME6O03	Supply Chain Management
8	B. Tech (ME)	V	191ME6O04	3D Printing
9	B. Tech (ME)	V	191ME6O05	Entrepreneurship Development and Incubation
10	B. Tech (ME)	V	191PR5P02	Socially Relevant Project
11	B. Tech (ME)	VI	191ME6E13	Alternative Fuels
12	B. Tech (ME)	VI	191ME6E16	Lean Manufacturing
13	B. Tech (ME)	VI	191ME6O06	Solar Energy Utilization
14	B. Tech (ME)	VI	191ME6O07	Basic Thermodynamics and Heat Transfer
15	B. Tech (ME)	VI	191ME6O08	Introduction to Hydraulics and Pneumatics
16	B. Tech (ME)	VI	191ME6O10	Robotics

BOS Chairperson

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Annexure-II

List of Courses Revised in the Academic Year 2021-22

S. No	Program	Semester	Course Code	Course Name
1	B. Tech (ME)	IV	201ME4T04	Theory of Machines-I
2	B. Tech (ME)	V	191ME5E03	Fluid Engineering
3	B. Tech (ME)	V	191ME5E04	Mechanical Vibrations
4	B. Tech (ME)	VI	191ME6E08	Mechatronics
5	B. Tech (ME)	VI	191ME6E12	Additive Manufacturing
6	M. Tech (TE)	II	192TE2E13	Jet Propulsion & Rocket Engineering
7	M. Tech (TE)	III	192TE3E19	Convective Heat Transfer

BOS Chairperson

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Annexure III

Action Taken Report on Stakeholders Feedback in the Academic Year 2021-22

S. No	Agenda Item No.	Stakeholders Recommended	Action Taken
1	8.3	In automotive, Technology is advancing day by day from conventional to hybrid, knowledge on electric usage must be known.	As suggested, introduction to electric vehicles will be introduced based on the discussion made.
2	8.10	Capability to acquire and apply fundamental principles of engineering is needed.	As per suggestions Internship is made mandatory and thereby the students should take the industry training.
3	8.3	Suggested to involve advanced manufacturing topics, where product based/ Automobile Engineers are looking nowadays in the curriculum.	According to the suggestions and discussions made, Design for Manufacturing and Assembly will be added to the curriculum.
4	8.10	A clear understanding on the material must be known to perform research.	As per suggestion received, introduction about ceramics will be introduced in the composite materials.
5	8.10	Due to the tremendous growth in theIT industry it is better to get known to programming related subjects.	As per suggestions, SOC (Skill Oriented Course) will be introduced to the curriculum.
6	8.3	It is better that students have knowledge on the cutting edge technologies.	According to the suggestion received, additive manufacturing will be introduced to the curriculum based on the discussions made.

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7	8.10	Every students to understand the basic principles of engineering and the introduction of biological concepts so that they can effectively interact to concern for providing solutions to the problems related to bio systems.	As suggested, biology for engineers willbe introduced into the curriculum.
8	8.10	It is better to have Knowledge on power plant operations and its working.	As per the suggestions, course on powerplant economics will be introduced.
9	8.4	It is better student have knowledge on the computer science related subjects during their graduation.	As per the suggestions and discussion made with the experts, BOS and Professionals, Honours and Minor degree programs will be introduced based on the students choice.
10	8.8	Better to add technical oriented courses so that student may be industry ready and can perform the project well.	As per suggestion, Technical courses such as CATIA, ANSYS and Solid edge will be taught in association with APSSDC.
11	8.12	Advancements in industries and job opportunities in the core must be known.	As per suggestion, seminars and workshops will be conducted in association with T2 and product based companies and global engineers.
12	8.10	Better to perform projects on the real time applications for better employment.	As per suggestions, it will be planned to discuss with the M.Tech coordinator and project guides for the implementation of experimental and analytical projects.

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13	8.10	Better to learn advanced courses for knowledge enhancement.	As per the suggestion received, student will be encouraged to take SWAYAM courses in accordance with discussion with deans.
14	8.10	For better placement in the companies, problem solving skills and performance of the student needs to be enhanced.	As per the feedback, AICTE and college will implement to get the access of PARAKH – SLAP to practice exams online for the placement.
15	8.12	Better to provide more technical sessions, webinars on the advanced topics.	As suggested, industrial orientation sessions from industry experts and global engineers will be initiated.

BOS Chairperson

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PROGRAM STRUCTURE

I SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
192TE1T01	Advanced Fluid Mechanics	PCC	3	0	0	3	3
192TE1T02	Computational Fluid Dynamics	PCC	3	0	0	3	3
---	Professional Elective-I	PEC	3	0	0	3	3
---	Professional Elective-II	PEC	3	0	0	3	3
192HS1T01	Research Methodology and IPR	HSMC	2	0	0	2	2
192TE1L01	Computational Fluid Dynamics Lab-1	PCC	0	0	4	4	2
192TE1L02	Thermal Engineering Lab-1	PCC	0	0	4	4	2
---	Audit Course-1	MC	2	0	0	2	0
		TOTAL	**16**	**0**	**8**	**24**	**18**

II SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
192TE2T03	Advanced Heat Transfer	PCC	3	0	0	3	3
192TE2T04	Thermal Measurement and Process Controls	PCC	3	0	0	3	3
---	Professional Elective-III	PEC	3	0	0	3	3
---	Professional Elective-IV	PEC	3	0	0	3	3
192TE2L03	Computational Fluid Dynamics Lab-II	PCC	0	0	4	4	2
192TE2L04	Thermal Engineering Lab-II	PCC	0	0	4	4	2
192TE2P01	Mini Project with Seminar	PROJ	2	0	0	2	2
---	Audit Course-2	MC	2	0	0	2	0
		TOTAL	**16**	**0**	**8**	**24**	**18**

III SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
---	Professional Elective-V	PEC	3	0	0	3	3
---	Open Elective	OEC	3	0	0	3	3
192TE3P02	Dissertation I/ Industrial Project	PROJ	0	0	20	20	0
		TOTAL	**6**	**0**	**20**	**26**	**6**

IV SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
192TE4P03	Dissertation II	PROJ	0	0	32	32	26
		TOTAL	**0**	**0**	**32**	**32**	**26**

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BSC: Basic Sciences Courses; HSMC: Humanities and Social Sciences including Management Courses; PCC: Professional Core Courses; PEC: Professional Elective Courses; OEC: Open Elective Courses; MC: Mandatory Courses; PROJ: Project.

Audit Course-1 & Audit Course-2 has to be chosen from the following list of courses.

S. No	Course Code		Name of the Course
	I Semester	II Semester	
1	192MC1A01	192MC2A01	English for Research Paper Writing
2	192MC1A02	192MC2A02	Disaster Management
3	192MC1A03	192MC2A03	Sanskrit for Technical Knowledge
4	192MC1A04	192MC2A04	Value Education
5	192MC1A05	192MC2A05	Constitution of India
6	192MC1A06	192MC2A06	Pedagogy Studies
7	192MC1A07	192MC2A07	Stress Management by Yoga
8	192MC1A08	192MC2A08	Personality Development through Life Enlightenment Skills
9	192MC1A09	192MC2A09	Soft Skills

Professional Elective – I (I Semester)

S.No	Course Code	Name of the Course
1	192TE1E01	Advanced IC Engines, Electric and Hybrid vehicles
2	192TE1E02	Gas Dynamics
3	192TE1E03	Cryogenic Engineering
4	192TE1E04	Advanced Thermodynamics

Professional Elective – II (I Semester)

S.No	Course Code	Name of the Course
1	192TE1E05	Gas Turbines
2	192TE1E06	Alternative Fuel Technologies
3	192TE1E07	Energy Conservation and Management
4	192TE1E08	Theory and Technology of Fuel Cells

Professional Elective – III (II Semester)

S.No	Course Code	Name of the Course
1	192TE2E09	Equipment Design for Thermal Systems
2	192TE2E10	Solar Energy Technologies
3	192TE2E11	Advanced Power Plant Engineering
4	192TE2E12	Combustion, Emissions and Environment

Professional Elective – IV (II Semester)

S.No	Course Code	Name of the Course
1	192TE2E13	Jet Propulsion and Rocket Engineering
2	192TE2E14	Automotive Engineering
3	192TE2E15	Modeling and I.C. Engines
4	192TE2E16	Renewable Energy Technologies

Professional Elective – V (III Semester)

S.No	Course Code	Name of the Course
1	192TE1E17	Optimization Techniques and Applications
2	192TE1E18	Design and Analysis of Experiments
3	192TE1E19	Convective Heat Transfer
4	192TE1E20	Waste to Energy
5	-------	MOOCs-I*

Open Elective (III Semester)

S.No	Course Code	Name of the Course
1	-----	MOOCs-II#
2	-----	Courses offered by other Departments in the College

***MOOCS-I:** A student should select a 12 weeks course which is not opted/ studied earlier.

#MOOCS-II: A student should select a 12 weeks course in Engineering/ Management/ Mathematics offered by other than parent department.

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Open Elective – Courses offered by Departments

S. No	Course Code	Name of the Course	Not offered to the students of the following M. Tech Specializations	Offered by Dept.
1.	192ST3O01	Repair & Rehabilitation of Structures	ST	CE
2.	192ST3O02	Green Building Systems	ST	CE
3.	192ST3O03	Basic Concrete Technology	ST	CE
4.	192ST3O04	Basic Foundation Engineering	ST	CE
5.	192PD3O01	Renewable Energy Technologies	PED	EEE
6.	192PD3O02	Hybrid Electric Vehicles	PED	EEE
7.	192PD3O03	Energy Audit and conservation Management	PED	EEE
8.	192PD3O04	Neural Networks and Fuzzy Logic	PED	EEE
9.	192PD3O05	Industrial Safety	PED	EEE
10.	192PD3O06	Composite Materials	PED	EEE
11.	192TE3O01	Energy Systems	TE	ME
12.	192TE3O02	Fuels and Combustion	TE	ME
13.	192TE3O03	Green Engineering Technology	ST, TE	ME
14.	192TE3O04	IC Engines	TE	ME
15.	192TE3O05	Automotive Technology	TE	ME
16.	192ES3O01	Embedded System Design	ES	ECE
17.	192ES3O02	Digital System Design	VLSID	ECE
18.	192ES3O03	Programming Languages for Embedded Systems	ES	ECE
19.	192ES3O04	Sensors & Actuators	ES	ECE
20.	192VD3O01	Physical Design Automation	VLSID	ECE
21.	192VD3O02	VLSI Technology	VLSID	ECE
22.	192VD3O03	Nano-electronics	VLSID	ECE
23.	192CS3O01	Python Programming (CSE)	CSE, SE	CSE
24.	192CS3O02	Principles of Cyber Security	CSE	CSE
25.	192CS3O03	Internet of Things	CSE, SE	CSE
26.	192CS3O04	Machine Learning	CSE, SE	CSE
27.	192CS3O05	Artificial Intelligence	SE	IT
28.	192CS3O06	Deep Learning	CSE, SE	IT
29.	192PE3O01	Introduction to Petroleum Engineering	PE	PT
30.	192PE3O02	Process Intensification	PE	PT
31.	192PE3O03	Fundamentals of Liquefied Natural Gas	PE	PT
32.	192PE3O04	Subsea Engineering	PE	PT
33.	192PE3O05	Geology	PE, ST	PT
34.	192PE3O06	HSE in Petroleum Industry	PE	PT

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JET PROPULSION AND ROCKET ENGINEERING
(Professional Elective-IV)

II Semester **L T P C**
Course Code: 192TE2E13 **3 0 0 3**

Course Objectives:

- COB 1: To make the student aware of turbojet propulsion systems & flight performance.
- COB 2: To enable the student understand about principles of rocketry and nozzle theory.
- COB 3: To enable the student aware of aero- thermo chemistry of combustion products
- COB 4: To enable the student understand about solid propellant rocket engine.

UNIT-I:

Turbo Jet Propulsion Systems:
Gas turbine cycle analysis, layout of turbo jet engine. Turbo machinery, compressors and turbines, combustor, blade aerodynamics, engine off design performance analysis.
Flight Performance: Forces acting on vehicle, Basic relations of motion, multi stage vehicles.

UNIT-II:

Principles of Jet Propulsion and Rocketry:
Fundamentals of jet propulsion, Rockets and air breathing jet engines, Classification, turbo jet, turbo fan, turbo prop, rocket (Solid and Liquid propellant rockets) and Ramjet engines.
Nozzle Theory and Characteristics Parameters: Theory of one dimensional convergent, divergent nozzles, aerodynamic choking of nozzles and mass flow through a nozzle, nozzle exhaust velocity, thrust, thrust coefficient, Ac / At of a nozzle, Supersonic nozzle shape, non, adapted nozzles, Summerfield criteria, departure from simple analysis, characteristic parameters,1) characteristic velocity, 2) specific impulse 3) total impulse 4) relationship between the characteristic parameters 5) nozzle efficiency, combustion efficiency and overall efficiency.

UNIT–III:

Aero Thermo Chemistry of the Combustion Products:
Review of properties of mixture of gases, Gibbs, Dalton laws, Equivalent ratio, enthalpy changes in reactions, heat of reaction and heat of formation, calculation of adiabatic flame temperature and specific impulse, frozen and equilibrium flows.
Solid Propulsion System: Solid propellants, classification, homogeneous and heterogeneous propellants, double base propellant compositions and manufacturing methods. Composite propellant oxidizers and binders. Effect of binder on propellant properties. Burning rate and burning rate laws, factors influencing the burning rate, methods of determining burning rates.

UNIT-IV:

Solid Propellant Rocket Engine:
Internal ballistics, equilibrium motor operation and equilibrium pressure to various parameters. Transient and pseudo equilibrium operation, end burning and burning

grains, grain design. Rocket motor hard ware design. Heat transfer considerations in solid rocket motor design. Ignition system, simple pyro devices.

Liquid Rocket Propulsion System: Liquid propellants, classification, Mono and Bi propellants, Cryogenic and storage propellants, ignition delay of hypergolic propellants, physical and chemical characteristics of liquid propellant. Liquid propellant rocket engine, system layout, pump and pressure feed systems, feed system components. Design of combustion chamber, characteristic length, constructional features, and chamber wall stresses. Heat transfer and cooling aspects. Uncooled engines, injectors, various types, injection patterns, injector characteristics, and atomization and drop size distribution, propellant tank design.

UNIT-V:

Ramjet and Integral Rocket Ramjet Propulsion System:

Fuel rich solid propellants, gross thrust, gross thrust coefficient, combustion efficiency of ramjet engine, air intakes and their classification, critical, super critical and sub, critical operation of air intakes, engine intake matching, classification and comparison of Integral Rocket Ramjet (IRR) propulsion systems.

Text Book:

1. Mechanics and Dynamics of Propulsion/ Hill and Peterson/John Wiley &Sons.
2. Rocket propulsion elements/Sutton/John Wiley & Sons/ 8th Edition.

Reference Books:

1. Gas Turbines, Ganesan, TMH, 3rd edition, 2017.
2. Gas Turbines & Propulsive Systems, Khajuria & Dubey, Dhanpat Rai & Sons, 2012.
3. Rocket propulsion, Bevere.
4. Jet propulsion, Nicholas Cumpsty, University of Cambridge, 3rd edition, 2015.

Web Links:

1. http://nptel.ac.in/courses/103103037/18
2. https://www.google.co.in/url?sa=t&rct
3. https://doc.lagout.org/electronics/Fundamentals%20of%20Industrial%20Instrumentation
4. https://www.azom.com/article.aspx?ArticleID=1245

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CONVECTIVE HEAT TRANSFER
(Professional Elective-V)

III Semester
Course Code: 192TE1E19

L	T	P	C
3	0	0	3

Course Objectives:

COB 1: To make the student to understand the basics of convective heat transfer.
COB 2: To enable student with free and forced convection in heat transfer.
COB 3: To impart knowledge of natural convection process.
COB 4: To enable with application of the combined heat transfer process.
COB 5: To help student to understand the concept of convection to porous media.

UNIT-I:

Introduction to free, forced combined convection, convective heat transfer coefficient, Application of dimensional analysis to convection, Physical interpretation of dimensionless numbers.

Equations of Convective Heat Transfer:

Continuity, Navier, Strokes equation & energy equation for steady state flows, similarity, Equations for turbulent convective heat transfer, Boundary layer equations for laminar, turbulent flows, Boundary layer integral equations.

UNIT-II:

External Laminar Forced Convection:

Similarity solution for flow over an isothermal plate, integral equation solutions, Numerical solutions, Viscous dissipation effects on flow over a flat plate.

External Turbulent Flows: Analogy solutions for boundary layer flows, Integral equation solutions, Effects of dissipation on flow over a flat plate.

Internal Laminar Flows: Fully developed laminar flow in pipe, plane duct & ducts with other cross, sectional shapes, Pipe flow & plane duct flow with developing temperature field, Pipe flows & plane duct flow with developing velocity & temperature fields.

Internal Turbulent Flows: Analogy solutions for fully developed pipe flow – Thermally developing pipe & plane duct flow.

UNIT–III:

Natural Convection:

Bouss in eqap proximation, Governing equations, Similarity, Boundary layer equations for free convective laminar flows, Numerical solution of boundary layer equations. Free Convective flows through a vertical channel across a rectangular enclosure, Horizontal enclosure, Turbulent natural convection.

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UNIT-IV:

Combined Convection:

Governing parameters & equations, laminar boundary layer flow over an isothermal vertical plate, combined convection over a horizontal plate, correlations for mixed convection, effect of boundary forces on turbulent flows, internal flows , internal mixed convective flows, Fully developed mixed convective flow in a vertical plane channel & in a horizontal duct.

UNIT-V:

Convective Heat Transfer Through Porous Media:

Area weighted velocity, Darcy flow model, energy equation, boundary layer solutions for 2, D forced convection, Fully developed duct flow, Natural convection in porous media, filled enclosures, stability of horizontal porous layers.

Text Books:

1. Convective Heat & Mass Transfer, Kays& Crawford, TMH, 4th edition, 2017.

Reference Books:

1. Introduction to Convective Heat Transfer Analysis, Patrick H. Oosthuigen & David Naylor, MGH, 1999.
2. Convection Heat Transfer, Adrian Bejan, Wiley 3rd edition, 2006.
3. Principles of Convective Heat Transfer, Kaviany Massoud, Springer, 2nd edition, 2001.

Web Links:

1. http://nptel.ac.in/downloads/112101004/
2. https://en.wikipedia.org/wiki/Cryogenics
3. https://home.cern/about/engineering/cryogenics-low-temperatures-high-performance

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Department of Mechanical Engineering

M.Tech-Thermal Engineering

Syllabus revision Index (2021-22)

S. No	Name of the course	Percentage of syllabus change
1	Jet Propulsion & Rocket Engineering	20 .
2	Convective Heat Transfer	20

Program Coordinator

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Department of Mechanical Engineering

1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Jet Propulsion & Rocketry	Jet Propulsion & Rocket Engineering
Course Code	172TE2E15	192TE2E13
Syllabus	**UNIT-I:** **Turbo Jet Propulsion System:** Gas turbine cycle analysis – layout of turbo jet engine. Turbo machinery-compressors and turbines, combustor, blade aerodynamics, engine off design performance analysis. Flight Performance: Forces acting on vehicle – Basic relations of motion – multi stage vehicles.	**UNIT-I:** **Turbo Jet Propulsion Systems:** Gas turbine cycle analysis, layout of turbo jet engine. Turbo machinery, compressors and turbines, combustor, blade aerodynamics, engine off design performance analysis. Flight Performance: Forces acting on vehicle, Basic relations of motion, multi stage vehicles
	UNIT-II: **Principles of Jet Propulsion and Rocketry:** Fundamentals of jet propulsion, Rockets and air breathing jet engines – Classification – turbo jet , turbo fan, turbo prop, rocket (Solid and Liquid propellant rockets) and Ramjet engines. Nozzle Theory and Characteristics Parameters: Theory of one dimensional convergent – divergent nozzles – aerodynamic choking of nozzles and mass flow through a nozzle – nozzle exhaust velocity – thrust, thrust coefficient, Ac At of a nozzle, Supersonic nozzle shape, no adapted nozzles, summer field criteria, departure from simple analysis – characteristic parameters – 1) characteristic velocity, 2) specific impulse 3) total impulse 4) relationship between the characteristic parameters 5) nozzle efficiency, combustion efficiency and overall efficiency.	**UNIT-II:** **Principles of Jet Propulsion and Rocketry:** Fundamentals of jet propulsion, Rockets and air breathing jet engines, Classification, turbo jet, turbo fan, turbo prop, rocket (Solid and Liquid propellant rockets) and Ramjet engines. Nozzle Theory and Characteristics Parameters: Theory of one dimensional convergent, divergent nozzles, aerodynamic choking of nozzles and mass flow through a nozzle, nozzle exhaust velocity, thrust, thrust coefficient, Ac / At of a nozzle, Supersonic nozzle shape, non, adapted nozzles, Summerfield criteria, departure from simple analysis, characteristic parameters,1) characteristic velocity, 2) specific impulse 3) total impulse 4) relationship between the characteristic parameters 5) nozzle efficiency, combustion efficiency and overall efficiency.

	UNIT-III: **Aero Thermo Chemistry of the Combustion Products:** Review of properties of mixture of gases – Gibbs – Dalton laws – Equivalent ratio, enthalpy changes in reactions, heat of reaction and heat of formation calculation of adiabatic flame temperature and specific impulse – frozen and equilibrium flows. Solid Propulsion System: Solid propellants – classification, homogeneous and heterogeneous propellants, double base propellant compositions and manufacturing methods. Composite propellant oxidizers and binders. Effect of binder on propellant properties. Burning rate and burning rate laws, factors influencing the burning rate, methods of determining burning rates	**UNIT-III:** **Aero Thermo Chemistry of the Combustion Products:** Review of properties of mixture of gases, Gibbs, Dalton laws, Equivalent ratio, enthalpy changes in reactions, heat of reaction and heat of formation, calculation of adiabatic flame temperature and specific impulse, frozen and equilibrium flows. Solid Propulsion System: Solid propellants, classification, homogeneous and heterogeneous propellants, double base propellant compositions and manufacturing methods. Composite propellant oxidizers and binders. Effect of binder on propellant properties. Burning rate and burning rate laws, factors influencing the burning rate, methods of determining burning rates.
	UNIT-IV: **Solid propellant rocket engine:** Internal ballistics, equilibrium motor operation and equilibrium pressure to various parameters. Transient and pseudo equilibrium operation, end burning and burning grains, grain design. Rocket motor hard ware design. Heat transfer considerations in solid rocket motor design. Ignition system, simple pyro devices. Liquid Rocket Propulsion System: Liquid propellants – classification, Mono and Bi propellants, Cryogenic and storage propellants, and ignition delay of hypergolic propellants, physical and chemical characteristics of liquid propellant. Liquid propellant rocket engine – system layout, pump and pressure feed systems, feed system components. Design of combustion chamber, characteristic length, constructional features, and chamber wall stresses. Heat transfer and cooling aspects. Uncooled engines, injectors – various types, injection patterns, injector characteristics, and atomization and drop size distribution, propellant tank design.	**UNIT-IV:** **Solid Propellant Rocket Engine:** Internal ballistics, equilibrium motor operation and equilibrium pressure to various parameters. Transient and pseudo equilibrium operation, end burning and burning grains, grain design. Rocket motor hard ware design. Heat transfer considerations in solid rocket motor design. Ignition system, simple pyro devices. Liquid Rocket Propulsion System: Liquid propellants, classification, Mono and Bi propellants, Cryogenic and storage propellants, ignition delay of hypergolic propellants, physical and chemical characteristics of liquid propellant. Liquid propellant rocket engine, system layout, pump and pressure feed systems, feed system components. Design of combustion chamber, characteristic length, constructional features, and chamber wall stresses. Ramjet and Integral Rocket Ramjet Propulsion System: Fuel rich solid propellants, gross thrust, gross thrust coefficient, combustion efficiency of ramjet engine, air intakes and their classification, critical, super critical and sub, critical operation of air intakes, engine intake matching.

	UNIT-V: **Ramjet and Integral Rocket Ramjet Propulsion System:** Fuel rich solid propellants, gross thrust, gross thrust coefficient, combustion efficiency of ramjet engine, air intakes and their classification – critical, super critical and subcritical operation of air intakes, engine intake matching, classification and comparison of IIRR propulsion systems.	**UNIT-V:** **Rocket Testing:** Types of Tests; Test Facilities and Safeguards; Safety and Environmental Concerns; Monitoring and Control of Toxic Materials and Exhaust Gases; Instrumentation and Data Management; Reliability and Quality Control; Flight Testing.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Convective Heat Transfer	Convective Heat Transfer
Course Code	172TE2E10	192TE1E19
Syllabus	**UNIT-I:** **Introduction:** Forced, free & combined convection – convective heat transfer coefficient – Application of dimensional analysis to convection – Physical interpretation of dimensionless numbers. Equations of Convective Heat Transfer: Continuity, Navier-Strokes equation & energy equation for steady state flows – similarity , Equations for turbulent convective heat transfer – Boundary layer equations for laminar, turbulent flows – Boundary layer integral equations.	**UNIT-I:** **Introduction**: Free, forced combined convection, convective heat transfer coefficient, Application of dimensional analysis to convection, Physical interpretation of dimensionless numbers. Equations of Convective Heat Transfer: Continuity, Navier, Strokes equation & energy equation for steady state flows, similarity, Equations for turbulent convective heat transfer, Boundary layer equations for laminar, turbulent flows, Boundary layer integral equations.
	UNIT-II: **External Laminar Forced Convection**: Similarity solution for flow over isothermal plate – integral equation solutions – Numerical solutions – Viscous dissipation effects on flow over a flat plate. External Turbulent Flows: Analogy solutions for boundary layer flows Integral equation solutions – Effects of dissipation on flow over a flat plate. Internal Laminar Flows: Fully developed laminar flow in pipe, plane duct & ducts with other cross-sectional shapes – Pipe flow & plane duct flow with developing temperature field – Pipe flows & plane duct flow with developing velocity & temperature fields. Internal Turbulent Flows: Analogy solutions for fully developed pipe flow – Thermally developing pipe & plane duct flow.	**UNIT-II:** **External Laminar Forced Convection**: Similarity solution for flow over isothermal plate – integral equation solutions – Numerical solutions – Viscous dissipation effects on flow over a flat plate. External Turbulent Flows: Analogy solutions for boundary layer flows Integral equation solutions – Effects of dissipation on flow over a flat plate. Internal Laminar Flows: Fully developed laminar flow in pipe, plane duct & ducts with other cross-sectional shapes – Pipe flow & plane duct flow with developing temperature field – Pipe flows & plane duct flow with developing velocity & temperature fields. Internal Turbulent Flows: Analogy solutions for fully developed pipe flow – Thermally developing pipe & plane duct flow.

	UNIT-III: **Natural Convection:** Boussineq approximation – Governing equations – Similarity –Boundary layer equations for free convective laminar flows – Numerical solution of boundary layer equations. Free Convective flows through a vertical channel across a rectangular enclosure – Horizontal enclosure – Turbulent natural convection.	**UNIT-III:** **Natural Convection:** Bouss in eqap proximation, Governing equations, Similarity, Boundary layer equations for free convective laminar flows, Numerical solution of boundary layer equations. Free Convective flows through a vertical channel across a rectangular enclosure, Horizontal enclosure, Turbulent natural convection
	UNIT-IV: **Combined Convection**: Governing parameters & equations – laminar boundary layer flow over an isothermal vertical plate – combined convection over a horizontal plate – correlations for mixed convection – effect of boundary forces on turbulent flows – internal flows - internal mixed convective flows – Fully developed mixed convective flow in a vertical plane channel & in a horizontal duct.	**UNIT-IV:** **Combined Convection:** Governing parameters & equations, laminar boundary layer flow over an isothermal vertical plate, combined convection over a horizontal plate, correlations for mixed convection, effect of boundary forces on turbulent flows, internal flows , internal mixed convective flows, Fully developed mixed convective flow in a vertical plane channel & in a horizontal duct Convective Heat Transfer Through Porous Media: Area weighted velocity, Darcy flow model, energy equation, boundary layer solutions for 2, D forced convection, Fully developed duct flow
	UNIT-V: **Convective Heat Transfer through Porous Media:** Area weighted velocity – Darcy flow model – energy equation – boundary layer solutions for 2- D forced convection – Fully developed duct flow – Natural convection in porous media – filled enclosures – stability of horizontal porous layers	**UNIT-V:** **Mass Transfer:** Types, Fick's law of diffusion, Steady state diffusion, Multicomponent diffusion, Measurement and prediction of diffusion coefficients, Diffusion in variable area, Molecular diffusion in liquids solids and gel, Knudsen diffusion. **Convective Mass Transfer and Mass Transfer Coefficients:** Types of mass transfer coefficient, dimensionless groups in mass transfer and various correlations Turbulent or eddy diffusion, Governing equations, forced diffusion from flat plate, dimension less correlation for mass transfer.

Course Coordinator

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Head of the Department

Program Name : M.Tech. in VLSI Design

Syllabus Revision for the Academic Year 2021-2022

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
1	I	192VD1T01	CMOS Analog IC Design	0
2	I	192VD1T02	CMOS Digital IC Design	0
3	I	192HS1T01	Research methodology and IPR	0
4	I	192VD1E01	VLSI Technology	0
5	I	192VD1E02	Nano materials and Nanotechnology	0
6	I	192VD1E03	MEMS Technology	20
7	I	192VD1E04	Device Modelling	0
8	I	192VD1E05	Nano-Electronics	0
9	I	192VD1E06	Photonics	20
10	I	192VD1L01	CMOS Analog IC Design Lab	0
11	II	192VD1L02	CMOS Digital IC Design Lab	0
12	II	192VD2T03	Mixed Signal & RF IC Design	0
13	II	192VD2T04	Physical Design Automation	0
14	II	192VD2E07	Design For Testability	0
15	II	192VD2E08	IoT & Its Applications	20
16	II	192VD2E09	VLSI Signal Processing	0
17	II	192VD2E10	Microcontrollers & programmable Digital Signal Processors	0
18	II	192EM2E11	Network Security & Cryptography	0
19	II	192VD2E11	Low Power VLSI Design	0
20	II	192VD2L03	Mixed Signal IC Design Lab	0
21	II	192VD2L04	Physical Design Automation Lab	0
22	II	192VD2P01	Mini Project with Seminar	0
23	II	192MC1A01/192MC2A01	English for Research Paper Writing	0
24	II	192MC1A02/192MC2A02	Disaster Management	0
25	II	192MC1A03/192MC2A03	Sanskrit for Technical Knowledge	0
26	II	192MC1A04/192MC2A04	Value Education	0
27	II	192MC1A05/192MC2A05	Constitution of India	0
28	II	192MC1A06/192MC2A06	Pedagogy Studies	0
29	II	192MC1A07/192MC2A07	Stress Management by Yoga	0
30	II	192MC1A08/192MC2A08	Personality Development through Life Enlightenment Skills	0
31	II	192MC1A09/192MC2A09	Soft Skills	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
32	III	192VD3E12	Scripting Languages for VLSI	0
33	III	192VD3E13	Digital System Design & Verification	0
34	III	192EM3E14	Hardware Software co-design	0
35	III	192ST3O01	Repair & Rehabilitation of Structures	0
36	III	192ST3O02	Green Building Systems	0
37	III	192ST3O03	Basic Concrete Technology	0
38	III	192ST3O04	Basic Foundation Engineering	0
39	III	192PD3O01	Renewable Energy Technologies	0
40	III	192PD3O02	Hybrid Electric Vehicles	0
41	III	192PD3O03	Energy Audit and conservation Management	0
42	III	192PD3O04	Neural Networks and Fuzzy Logic	0
43	III	192PD3O05	Industrial Safety	0
44	III	192PD3O06	Composite Materials	0
45	III	192TE3O01	Energy Systems	0
46	III	192TE3O02	Fuels and Combustion	0
47	III	192TE3O03	Green Engineering Technology	0
48	III	192TE3O04	IC Engines	0
49	III	192TE3O05	Automotive Technology	0
50	III	192ES3O01	Embedded System Design	0
51	III	192ES3O03	Programming Languages for Embedded Systems	0
52	III	192ES3O04	Sensors & Actuators	0
53	III	192CS3O01	Python Programming (CSE)	0
54	III	192CS3O02	Principles of Cyber Security	0
55	III	192CS3O03	Internet of Things	0
56	III	192CS3O04	Machine Learning	0
57	III	192CS3O05	Artificial Intelligence	0
58	III	192CS3O06	Deep Learning	0
59	III	192PE3O01	Introduction to Petroleum Engineering	0
60	III	192PE3O02	Process Intensification	0
61	III	192PE3O03	Fundamentals of Liquefied Natural Gas	0
62	III	192PE3O04	Subsea Engineering	0
63	III	192PE3O05	Geology	0
64	III	192PE3O06	HSE in Petroleum Industry	0
65	III	192VD3P03	Dissertation-I/ Industrial Project	0
66	IV	192VD4P04	Dissertation-II	0

Total number of courses in the academic year 2021-2022	66
Number of courses having revision in syllabus content >/= 20% in the academic year 2021-2022	3
Percentage of syllabus revision carried out in the academic year 2021-2022 = (49/135)*100	4.54%

Program Coordinator

Head of the Department

Head of the Department
Department of E.C.E.
Aditya Engineering College (A9)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MINUTES OF THE VIII MEETING OF BOS SCHEDULED ON 25-04-2022

Date: 26-04-2022

The VIII meeting of the BOS of Electronics and Communication Engineering Department was held on 25-04-2022 at 09.30 AM.

The Members discussed the agenda items and made the following resolutions.

Agenda 8.1: Welcome address by Chairman

Dr. G. Sridevi, Chairman of BOS, invited all the distinguished members of BOS to the first BOS meeting.

Agenda 8.2: Ratification of minutes of the previous Board of Studies meeting.

The BOS members have ratified the points discussed in the previous Board of Studies meeting held on 07-10-2021.

Agenda 8.3: Discussion on proposed AR20B.Tech (ECE) V, VI, VII and VIII semesters syllabus and ratification of the same.

The BOS members approved the AR20B.Tech (ECE) V, VI, VII and VIII semesters syllabus after incorporating the following changes in the proposed syllabus.

The members of BOS suggested the following changes to the proposed AR19 VI, VII and VIII Semester B.Tech (ECE):

- Suggested to include Industrial IoT concepts in the Internet of Things course of VI semester.
- Suggested to include current advancements as augmented experiments in IoT laboratory course of VI semester.
- Suggested to include some of the Nano Electronics concepts in VLSI course of VI semester.
- Suggested to make "Modern VLSI Design: System-on-Chip Design, Wolf Wayne" as a text book instead of reference book.
- Suggested to include counters / registers based experiments in VLSI laboratory course of VI semester.
- Suggested to include Cryptography concepts like error control coding, RS, DES and AES algorithms in Information Theory and Coding course (Professional Elective –II) of VI semester.

- Suggested to remove MTI Radar and concentrate more on Range Gated Doppler Radar in UNIT-II of Radar Systems course in VI semester.
- Suggested to reframe the syllabus contents of Embedded C course (Professional Elective –III) in VI semester.
- Suggested to include overview of evolutionary techniques for testing in Design for Testability course (Professional Elective –III) of VI semester.
- Suggested to frame the syllabus of Signal Transform Techniques course of VI semester in an application-oriented approach as it seems to be mathematical course.
- Suggested to include power link budgeting concept and frame the syllabus in a qualitative approach for Microwave and Optical Communication course in VII semester.

Agenda 8.4: Discussion on proposed AR20 Honor and Minor Degree Courses syllabus and ratification of the same.

After long discussions with the BOS members on the proposed list of courses offered to obtain Honor degree in ECE and Minor degree under AR20 B.Tech Regulation and the following suggestions are made:

- Suggested to frame a course with Advanced Modulation techniques and coding techniques instead of Optical Networks in IV semester of Honors Degree program structure.
- Suggested to frame the syllabus of Open Elective courses and Minor Degree courses in a qualitative approach.
- Suggested to give different the course names for Open Elective courses and Minor Degree courses to avoid ambiguity at the time examination conduction.

Agenda 8.5: Discussion on value added courses offered for the students and ratification of the same.

Members of BOS ratified the following value- added courses identified for the students to be offered and suggested to include topics related to thrust areas.

- Signal and Image Processing using MATLAB
- NI_LabVIEW
- PCB Designing
- AWS Cloud Computing
- Arduino based Programming
- Block chain Technology
- Cyber security Essentials
- Machine Learning using Python

Agenda 8.6: Discussion on the new courses offered in the B.Tech(ECE) program and ratification of the same.

Members of BOS noted the new courses offered in the B.Tech (ECE) program and ratified the same.The list of new courses during the academic year 2021-2022 enclosed as Annexure-I.

Agenda 8.7: Discussion on the percentage of the syllabus revision has done in the B.Tech(ECE) & M.Tech(VLSI Design) programs and ratification of the same.

The syllabus revisions done in B.Tech(ECE) & M.Tech(VLSI Design) programs based on the Stakeholders feedback on curriculum. The BOS members have approved all the syllabus revisions in B.Tech(ECE) & M.Tech(VLSI Design) programs. The list of courses revised during the academic year 2021-2022 is enclosed as Annexure-II.

Agenda 8.8: Discussion on the courses having focus on employability/ entrepreneurship/ skill development in the program of B.Tech(ECE) & M.Tech(VLSI Design) programs and ratification of the same.

The members of BOS ratified the courses having focus on employability/entrepreneurship/skill development in the B.Tech(ECE) & M.Tech(VLSI Design) programs.

Agenda 8.9: Discussion on the B.Tech(ECE) & M.Tech(VLSI Design) programs in which Choice Based Credit System (CBCS)/elective course system is being implemented and ratification of the same.

Members of BOS ratified the choice based credit systems (CBCS)/elective course system that is being implemented in B.Tech(ECE) & M.Tech(VLSI Design) programs.

Agenda 8.10: Analysis of Stakeholder's Feedback on Curriculum

The BOS Chairperson presented the analysis report of Stakeholder's feedback on curriculum. The BOS members noted the sameand the Action Taken Report is enclosed as Annexure-III.

Agenda 8.11: Analysis of Results of the odd semester of the academic year 2021-22.

The BOS Chairperson presented the odd semesters pass percentage for the A. Y. 2021-2022. The BOS members noted the same.

Agenda 8.12: Analysis of students feedback in the odd semester of the academic year 2021-22

BOS Chairperson expressed that the student feedback in academic year 2021-2022for odd semester. The BOS members noted the same

Agenda 8.13: Any other items with the approval of Chairperson

More emphasis should be given on laboratories with design oriented experiments.

Agenda 8.14: Scheduling of next Board of Studies meeting.

The next BOS meeting is tentatively scheduled in the month of December 2022.

Agenda 8.15: Vote of Thanks

Dr. G.Sridevi, BOS Chairperson presented the Vote of thanks.

G. Sridevi 26/4/22

Chairperson, BOS

Head of the Department
Department of E.C.E.
Aditya Engineering College (A9)

Department of Electronics and Communication Engineering

ANNEXURE-I

LIST OF NEW COURSES IN THE ACADEMIC YEAR 2021-2022

S. No	Program	Semester	Course Code	Course Name
1	B. Tech (ECE)	V	191PR5P02	Socially Relevant Project
2	B. Tech (ECE)	III	201EC3L02	Signals and Systems Lab
3	B. Tech (ECE)	III	201SO3L04	Skill Oriented Course I: Python Programming
4	B. Tech (ECE)	IV	201SC4L16	Skill Oriented Course-II: a) PCB Designing
5	B. Tech (ECE)	IV	201SC4L17	Skill Oriented Course-II: b) Applications of Python Programming
6	B. Tech (ECE)	V	191EC5E02	Digital System Design-I
7	B. Tech (ECE)	V	191EC5E03	Electromagnetic Interference & Compatibility
8	B. Tech (ECE)	V	191EC5E04	Python Programming
9	B. Tech (ECE)	V	191EC5O01	Signals & Systems
10	B. Tech (ECE)	V	191EC5O02	Digital Electronics and Logic Design
11	B. Tech (ECE)	V	191EC5O03	Semi conductor devices
12	B. Tech (ECE)	VI	191EC6E05	Digital System Design-II
13	B. Tech (ECE)	VI	191EC6E08	Soft Computing Techniques
14	B. Tech (ECE)	VI	191EC6E10	Embedded C
15	B. Tech (ECE)	VI	191EC6E09	Design for Testability
16	B. Tech (ECE)	VI	191EC6E12	Signal Transform Techniques
17	B. Tech (ECE)	VI	191EC6O04	Biomedical Instrumentation
18	B. Tech (ECE)	VI	191EC6O05	ECAD Tools
19	B. Tech (ECE)	VI	191EC6L07	Internet of Things Lab

G. Sridevi

BOS Chairperson

Head of the Department
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ADITYA ENGINEERING COLLEGE

An Autonomous Institution

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Recognised by UGC under sections 2(f) and 12(B) of UGC Act, 1956

Aditya Nagar, ADB Road, Surampalem - 533437, Near Kakinada, E.G.Dt., Ph:99498 76662

Department of Electronics and Communication Engineering

ANNEXURE-II

LIST OF COURSES REVISED IN THE ACADEMIC YEAR 2021-2022

S. No	Program	Semester	Course Code	Course Name
1	B. Tech (ECE)	V	191EC5E01	Computer System Architecture
2	B. Tech (ECE)	V	191EC5L05	Integrated circuits and applications lab
3	B. Tech (ECE)	VI	191EC6T13	VLSI Design
4	B. Tech (ECE)	VI	191EC6E07	Information Theory and Coding
5	B. Tech (ECE)	VI	191EC6L08	VLSI Lab
6	M. Tech (VLSID)	I	192VD1E03	MEMS Technology
7	M. Tech (VLSID)	I	192VD1E06	Photonics
8	M. Tech (VLSID)	II	192VD2E08	IoT & Its Applications

G. Saidns

BOS Chairperson

Head of the Department
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ANNEXURE III

S. No	Agenda Item No.	Stakeholders Recommended	Action Taken
1	8.10	Institution and Industry interaction is needed for the students.	Institute has signed MOUs with renowned industries to cater the students to aware of real time applications and recent trends in Industries. Internship is made mandatory. Regular Visit to Industry.
		Include cutting technologies in the syllabus	In the revised Syllabus. Open Elective I, II, III & IV are introduced and all the emerging technologies are included in these courses.
		Include a greater number of courses related to IT.	Web Technologies, Cyber Security, Operating Systems are in electives. can be opted by students who are interested in IT sector as their career.
2	8.10	Differential equations and linear algebra, Applied Physics courses are included in I^{ST} semester. It will be a difficult task for fresh engineering graduate to handle two mathematical background courses in the very first semester. This may be taken care of to reduce the burden over an average performing students.	Applied Physics course in the first semester is substituted with the course Engineering chemistry and Applied Physics is included in the second semester.
		Environmental Science and Constitution of India are included in the same semester which is non- technical courses. Please substitute one of the courses with a technical course.	The course Engineering Graphics and Design is included in the first semester and Constitution of India is included in the second semester.

		A course should be included in the curriculum which provides a proper guideline for project work.	Engineering exploration project appears in the II semester to provide an insight to how to carry out an effective project work by students.
3	8.10	Increase industrial training practically	Internship is made mandatory and thereby the students should take the industry training and to implement a project as part of Internship.
		workshops and FDPs which focuses on outcome-based education should be organized.	Recommendation will be taken forward to the concerned body.
		It was observed that quiet number of students are showing interest towards animation and VFX technologies. Proper guidance may be suggestable.	3D PRINTING course is included in the syllabus offering as elective. Students who are interested can opt for the course.
4	8.12	It will be helpful to the students if the students come across department related courses in the early semester itself. This helps the students in having an insight on GATE and other competitive exams.	Integrated circuits and applications course is included in the curriculum in the IV semester which is one of the core subjects of electronics and communication engineering course.
		Students get benefitted if coding or programming related course is introduced in the early semesters so that by the end of the graduation the student will be industry ready.	Skill oriented courses, Python programming, PCB design, Applications of Python Programming are introduced in the III and IV semesters to have an exposure on cutting edge technologies.
		In Network Analysis course, filters topic which cannot be handled by a student in the early semesters. It should be excluded from the course.	Filters topic is excluded from Network Analysis as it appears in the other courses in the up-coming semesters.

G. Seidross

BOS Chairperson

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21-22

PROGRAM STRUCTURE

I SEMESTER

Course Code	Course Title	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
192VD1T01	CMOS Analog IC Design	PCC	3	0	0	3	3
192VD1T02	CMOS Digital IC design	PCC	3	0	0	3	3
---	Professional Elective – I	PEC	3	0	0	3	3
---	Professional Elective - II	PEC	3	0	0	3	3
192HS1T01	Research methodology and IPR	HSMC	2	0	0	2	2
192VD1L01	CMOS Analog IC Design Lab	PCC	0	0	4	4	2
192VD1L02	CMOS Digital IC Design Lab	PCC	0	0	4	4	2
---	Audit course-1	MC	2	0	0	2	0
		TOTAL	**16**	**0**	**8**	**24**	**18**

II SEMESTER

Course Code	Course Title	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
192VD2T03	Mixed Signal & RF IC Design	PCC	3	0	0	.3	3
192VD2T04	Physical Design Automation	PCC	3	0	0	3	3
---	Professional Elective – III	PEC	3	0	0	3	3
---	Professional Elective - IV	PEC	3	0	0	3	3
192VD2L03	Mixed Signal IC Design Lab	PCC	0	0	4	4	2
192VD2L04	Physical Design Automation Lab	PCC	0	0	4	4	2
192VD2P01	Mini Project with Seminar	PROJ	0	0	4	4	2
---	Audit Course – 2	MC	2	0	0	2	0
		TOTAL	**14**	**0**	**12**	**26**	**18**

III SEMESTER

Course Code	Course Title	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
---	Professional Elective - V	PEC	3	0	0	3	3
---	Open Elective	OEC	3	0	0	3	3
192VD3P03	Dissertation-I/ Industrial Project	PROJ	0	0	20	20	0
		TOTAL	**3**	**0**	**20**	**26**	**06**

IV SEMESTER

Course Code	Course Title	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
192VD4P04	Dissertation-II	PROJ	0	0	32	32	26
		TOTAL	**0**	**0**	**32**	**32**	**26**

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BSC: Basic Sciences Courses; HSMC: Humanities and Social Sciences including Management Courses; PCC: Professional Core Courses; PEC: Professional Elective Courses; OEC: Open Elective Courses; MC: Mandatory Courses; PROJ: Project.

Audit Course -1 & Audit Course -2 has to be chosen from the following list of courses.

S. No	Course Code		Name of the Course
	I Semester	II Semester	
1	192MC1A01	192MC2A01	English for Research Paper Writing
2	192MC1A02	192MC2A02	Disaster Management
3	192MC1A03	192MC2A03	Sanskrit for Technical Knowledge
4	192MC1A04	192MC2A04	Value Education
5	192MC1A05	192MC2A05	Constitution of India
6	192MC1A06	192MC2A06	Pedagogy Studies
7	192MC1A07	192MC2A07	Stress Management by Yoga
8	192MC1A08	192MC2A08	Personality Development through Life Enlightenment Skills
9	192MC1A09	192MC2A09	Soft Skills

Professional Elective – I (I Semester)

S. No	Course Code	Name of the Course
1	192VD1E01	VLSI Technology
2	192VD1E02	Nano materials and Nanotechnology
3	192VD1E03	MEMS Technology

Professional Elective – II (I Semester)

S. No	Course Code	Name of the Course
1	192VD1E04	Device Modelling
2	192VD1E05	Nano-Electronics
3	192VD1E06	Photonics

Professional Elective – III (II Semester)

S. No	Course Code	Name of the Course
1	192VD2E07	Design For Testability
2	192VD2E08	IoT & Its Applications
3	192VD2E09	VLSI Signal Processing

Professional Elective – IV (II Semester)

S. No	Course Code	Name of the Course
1	192VD2E10	Microcontrollers & programmable Digital Signal Processors
2	192EM2E11	Network Security & Cryptography
3	192VD2E11	Low Power VLSI Design

Professional Elective – V (III Semester)

S. No	Course Code	Name of the Course
1	192VD3E12	Scripting Languages for VLSI
2	192VD3E13	Digital System Design & Verification
3	192EM3E14	Hardware Software co-design
4	---	MOOCs - I*

Open Elective (III Semester)

S. No	Course Code	Name of the Course
1	---	MOOCs- II #
2	---	Courses offered by other departments in the college

***MOOCS- I:** A student should select a 12 weeks course which is not opted/ studied earlier.

 # MOOCS- II: A student should select a 12 weeks course in Engineering/ Management/ Mathematics offered by other than parent department.

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Open Elective – Courses offered by Departments

S. No	Course Code	Name of the Course	Not offered to the students of the following M.Tech Specializations	Offered by Dept.
1.	192ST3O01	Repair & Rehabilitation of Structures	ST	CE
2.	192ST3O02	Green Building Systems	ST	CE
3.	192ST3O03	Basic Concrete Technology	ST	CE
4.	192ST3O04	Basic Foundation Engineering	ST	CE
5.	192PD3O01	Renewable Energy Technologies	PED	EEE
6.	192PD3O02	Hybrid Electric Vehicles	PED	EEE
7.	192PD3O03	Energy Audit and conservation Management	PED	EEE
8.	192PD3O04	Neural Networks and Fuzzy Logic	PED	EEE
9.	192PD3O05	Industrial Safety	PED	EEE
10.	192PD3O06	Composite Materials	PED	EEE
11.	192TE3O01	Energy Systems	TE	ME
12.	192TE3O02	Fuels and Combustion	TE	ME
13.	192TE3O03	Green Engineering Technology	ST,TE	ME
14.	192TE3O04	IC Engines	TE	ME
15.	192TE3O05	Automotive Technology	TE	ME
16.	192ES3O01	Embedded System Design	ES	ECE
17.	192ES3O02	Digital System Design	VLSID	ECE
18.	192ES3O03	Programming Languages for Embedded Systems	ES	ECE
19.	192ES3O04	Sensors & Actuators	ES	ECE
20.	192VD3O01	Physical Design Automation	VLSID	ECE
21.	192VD3O02	VLSI Technology	VLSID	ECE
22.	192VD3O03	Nano-electronics	VLSID	ECE
23.	192CS3O01	Python Programming (CSE)	CSE, SE	CSE
24.	192CS3O02	Principles of Cyber Security	CSE	CSE
25.	192CS3O03	Internet of Things	CSE, SE	CSE
26.	192CS3O04	Machine Learning	CSE, SE	CSE
27.	192CS3O05	Artificial Intelligence	SE	IT
28.	192CS3O06	Deep Learning	CSE, SE	IT
29.	192PE3O01	Introduction to Petroleum Engineering	PE	PT
30.	192PE3O02	Process Intensification	PE	PT
31.	192PE3O03	Fundamentals of Liquefied Natural Gas	PE	PT
32.	192PE3O04	Subsea Engineering	PE	PT
33.	192PE3O05	Geology	PE, ST	PT
34.	192PE3O06	HSE in Petroleum Industry	PE	PT

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21-22

MEMS TECHNOLOGY

(Professional Elective-I)

I Semester **L T P C**
Course Code: 192VD1E03 **3 0 0 3**

Course Objectives:

- COB 1: To Learn Basics of Micro Electro and Mechanical Systems and it's Working.
- COB 2: To Learn Different MEMS Materials and it's Technologies for Different Applications.
- COB 3: To learn the Fabrication Processes of MEMS.

Course Outcomes:

At the end of the Course, Student will be able to:

- CO 1: To understand the basic concepts of MEMS technology and working of MEMS devices.
- CO 2: To understand and selecting different materials for current MEMS devices and competingTechnologies for future applications.
- CO 3: To understanding the concepts of fabrication process of MEMS, Design and Packaging Methodology.
- CO 4: To analyse the various fabrication techniques in the manufacturing of MEMS Devices.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO 1 (K5)	PO 2 (K4)	PO 3 (K5)	PO 4 (K3)	PO 5 (K3)	PO 6 (K4)	PO 7 (K6)	PO 8 (K2)	PO 9 (K2)	PO 10 (K2)	PO 11 (K4)
CO 1(K2)	1	-	-	-	-	-	-	-	-	-	-
CO 2(K2)	-	1	-	-	-	-	-	-	-	-	-
CO 3(K2)	-	1	1	-	-	-	-	-	-	-	-
CO 4(K4)	-	-	2	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1 (K3)	PSO 2 (K4)	PSO 3 (K6)
CO 1(K2)	1	-	1
CO 2(K2)	1	-	1
CO 3(K2)	1	-	1
CO 4(K4)	1	-	3

UNIT-I:

Introduction to MEMS:

Introduction to MEMS& Real world Sensor/Actuator examples (DMD, Air-bag, pressure sensors). MEMS Sensors in Internet of Things (IOT), Bio-Medical Applications.

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UNIT-II:

MEMS Materials and Their Properties:

Materials (eg.Si, SiO2, SiN, Cr, Au, Ti, SU8, PMMA, Pt);Important properties: Young modulus, Poisson "sratio, density, piezo-resistive coefficients, TCR, Thermal Conductivity, Material Structure. Understanding Selection of materials based on applications.

UNIT-III:

MEMS Fab Processes–1:

Understanding MEMS Processes& Process parameters for: Cleaning, Growth& Deposition, Ion Implantation &Diffusion, Annealing, Lithography. Understanding selection of Fab processes based on Applications.

UNIT-IV:

MEMS Fab Processes–2:

Understanding MEMS Processes &Process parameters for: Wet & Dry etching, Bulk & Surface Micromachining, Die, Wire & Wafer Bonding, Dicing, Packaging. Understanding selection of Fab processes based on Applications.

UNIT-V:

MEMS Devices:

Architecture, working and basic quantitative behavior of Cantilevers, Microheaters, Accelerometers, Pressure Sensors, Micromirror sin DMD, Inkjet printer-head. Understanding steps involved in Fabricating above devices.

Text Books:

1. An Introduction to Micro electro mechanical Systems Engineering; 2nd Ed-by N.Maluf, K Williams; Publisher: Artech House Inc.
2. Practical MEMS- by Ville Kaajakari; Publisher: Small Gear Publishing.
3. Microsystem Design - byS. Senturia; Publisher: Springer.

Reference Books:

1. Analysis and Design Principles of MEMS Devices- Minhang Bao; Publisher: Elsevier Science.
2. Fundamentals of Micro fabrication- by M. Madou; Publisher: CRC Press; 2nd edition.
3. Micro Electro Mechanical System Design- byJ. Allen; Publisher: CRC Press.
4. Micromachined Transducers Sourcebook- byG. Kovacs; Publisher: McGraw-Hill.

G. Sridhar

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PHOTONICS

(Professional Elective-II)

I Semester **L T P C**

Course Code: 192VD1E06 **3 0 0 3**

Course objectives:

COB 1: To enable the students to understand the radiation properties of LASERS with a basic knowledge on active and passive modeling techniques.

COB 2: To impart the knowledge on opto-electronic components such as the optical sources and receptors at discrete component level.

COB 3: To impart the knowledge on opto-electronic systems with the help of opto-electronic components.

COB 4: To make the students to know the various techniques which are used to apply in various optical communication systems with the help of light or optical modulation.

Course Outcomes:

At the end of the Course, Student will be able to:

CO 1: Classify the Optical sources and detectors and to discuss their principle.

CO 2: Understand the Design considerations of fiber optic systems.

CO 3: Analyse the basic methodologies behind the manufacturing of different LED materials.

CO 4: Apply the principles of atomic physics to materials used in optics and photonics.

CO 5: Use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanations.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO 1 (K5)	PO 2 (K4)	PO 3 (K5)	PO 4 (K3)	PO 5 (K3)	PO 6 (K4)	PO 7 (K6)	PO 8 (K2)	PO 9 (K2)	PO 10 (K2)	PO 11 (K4)
CO1 (K2)	2	1	-	-	-	-	-	1	-	-	-
CO2 (K2)	1	2	1	-	-	-	-	-	-	-	-
CO3 (K4)	2	3	1	-	-	-	-	-	-	-	-
CO4 (K3)	1	-	-	-	-	-	-	-	-	-	-
CO5 (K5)	3	2	3	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1 (K3)	PSO 2 (K4)	PSO 3 (K6)
CO1 (K2)	2	1	-
CO2 (K2)	2	1	-
CO3 (K4)	2	3	-
CO4 (K3)	3	2	-
CO5 (K5)	1	2	-

UNIT-I:

Laser Systems:

General description, Laser structure, Single mode laser theory, Excitation mechanism and working of: CO2, Nitrogen, Argonion, Excimer, X-ray, Free-electron, Dye, Nd: YAG, Alexanderite and Ti: sapphire lasers, Diode pumped solid state laser, Optical parametric oscillator (OPO) lasers. Optical amplifiers-Semiconductor optical

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amplifiers, Erbium doped waveguide optical amplifiers, Raman amplifiers, Fiber Lasers. Laser Applications-Lasers in Isotope separation, Laser interferometry and speckle metrology, Velocity measurements.

UNIT-II:

Properties of laser Radiation:

Introduction, Laser line width ,Laser frequency stabilization, Beam divergence, Beam coherence, Brightness ,Focusing properties of laser radiation, Q-switching ,Methods of Q-switching: Rotating-mirror method ,Electro- optic Q-switching, Acoustic- optic Q-switching and Passive Q-switching, Mode locking, Methods of mode locking: Active and passive mode locking techniques, Frequency doubling and Phase conjugation

UNIT-III:

Opto -Electronic Devices-I:

Introduction, P-N junction diode, Carrier recombination and diffusion in P-N junction, Injection efficiency, Internal quantum efficiency, Hetero-junction, Double hetero-junction, Quantum well, Quantum dot and Super lattices; LED materials, Device configuration and efficiency.

UNIT-IV:

Opto-Electronic Devices-II:

Light extraction from LEDs, LED structures-single hetero structures, double heteros structures, Device performances and applications, Quantum well lasers; Photodiode and Avalanche photodiodes (APDs), Laser Diodes-Amplification, Feedback and oscillation, Power and efficiency, Spectral and spatial characteristics.

UNIT–V:

Modulation of Light:

Introduction, Birefringence, Electro-optic effect, Pockets and Kerr effects, Electro-optic Phase modulation, Electro-optic amplitude modulation, Electro-optic modulators: scanning and switching, Acousto-optic effect, Acousto-optic modulation, Raman-Nath and Bragg modulators: deflectors and spectrum analyzer, Magneto-optic effect, Faraday rotator and optical isolator. Advantages of optical modulation.

Text Books:

1. Lasers: Principles and applications by J.Wilson And J.F.B.Hawkes, Prentice, Hall of India, New Delhi, 1996.
2. Laser fundamentals, W.T.Silfvast, Foundation books, New Delhi, 1999.
3. Semi conductor opto electronics devices, P. Bhattacharya, Prentice– Hall of India, New Delhi, 1995.17.

Reference Books:

1. Optical fiber communications, John M. Senior, Prentice-Hall of India, New Delhi, 2001.
2. Optoelectronics: An Introduction, J.Wilson And J.F.B. Hawkes, Prentice-Hall of India, New Delhi, 1996.
3. Electro-Optical devices, M.A. Karim, Boston, Pws-Kent Publishers, 1990.

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Web Links:

1. EDx course on "Optical Devices and Materials
   url: https://www.edx.org/course/optical-materials-devices-mitx-3-15-2x-0
2. NPTEL Course on "Introduction to Photonics"
   url: https://nptel.ac.in/courses/108106135/
3. University of Colarado course on "Photonics and Optics"
   url: https://www.colorado.edu/ecee/msee/curriculum/photonics-and-optics
4. Coursera on "LED's and LASERS"
   url: https://www.coursera.org/learn/leds-semiconductor-lasers

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IoT AND ITS APPLICATIONS

(Professional Elective-III)

II Semester **L T P C**

Course Code: 192VD2E08 **3 0 0 3**

Course Objectives:

COB 1: To make the students to aware of Fundamentals of IoT along with IoT supported hardware platforms.

COB 2: To impart the knowledge on IoT Protocols used for Different Layers.

COB 3: To impart the knowledge on Design and Development of IoT Applications with appropriate Software's and Hardware's.

COB 4: To make the students to aware of Data Analytics and Supporting Services for IoT Applications.

COB 5: To impart the knowledge on Case Studies/Industrial Applications with respect to IoT.

Course Outcomes:

At the end of the Course, Student will be able to:

CO 1: Explain the various technologies in IoT Architectures and IoT Platforms.

CO 2: Apply Different Layer Protocols for building an IoT Network for the Applications.

CO 3: Develop an IoT Applications using appropriate software's and hardware's.

CO 4: Analyze the Data flow in the IoT Networks with appropriate frameworks.

CO 5: Analyze the real time IoT Applications with different case studies.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO 1 (K5)	PO 2 (K4)	PO 3 (K5)	PO 4 (K3)	PO 5 (K3)	PO 6 (K4)	PO 7 (K6)	PO 8 (K2)	PO 9 (K2)	PO 10 (K2)	PO 11 (K4)
CO 1(K2)	3	1	-	-	-	-	-	-	-	-	-
CO 2(K3)	1	2	-	-	-	-	-	-	-	-	-
CO 3(K3)	1	2	1	-	-	-	-	-	-	-	-
CO 4(K4)	-	-	2	-	3	-	-	-	-	-	-
CO 5(K4)	-	3	2	-	3	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1 (K3)	PSO 2 (K4)	PSO 3 (K6)
CO 1(K2)	2	-	-
CO 2(K3)	3	-	-
CO 3(K3)	3	2	-
CO 4(K4)	-	3	1
CO 5(K4)	3	3	1

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UNIT-I:

Fundamentals of IoT:
Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum (IoT WF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards.

UNIT-II:

IoT Protocols:
IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: Co AP and MQTT.

UNIT-III:

Design And Development:
Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.

UNIT-IV:

Data Analytics And Supporting Services:
Structured Vs Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning – No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web Application Framework, Django, AWS for IoT, System Management with NETCONF-YANG.

UNIT-V:

Case Studies/Industrial Applications:
IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts.

Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino).

Text Books:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.

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Reference Books:

1. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015.
2. The Internet of Things – Key applications and Protocols, Olivier Her sent, David Boswar thick, Omar Elloumi and Wiley, 2012 (for Unit 2).
3. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Jan Ho¨ ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Aves and. David Boyle and Elsevier, 2014.
4. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.
5. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O "Reilly Media, 2011.

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Aditya Nagar, ADB Road, Surampalem - 533437, Near Kakinada, E.G.Dt., Ph:99498 76662

Department of Electronics and communication Engineering

Syllabus revision Index (V.L.S.I.D.)

2021-22

S.No	Name of the course	Percentage of syllabus change
1	MEMS Technology	20
2	Photonics	20
3	IoT & Its Applications	20

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	MEMS Technology	MEMS Technology
Course Code	192VD1E03	192VD1E03
Syllabus	**UNIT-I:** **Introduction to MEMS:** Introduction to MEMS& Real world Sensor/Actuator examples (DMD, Air-bag, pressure sensors). MEMS Sensors in Internet of Things (IOT), Bio-Medical Applications.	**UNIT-I:** **Introduction to MEMS:** Introduction to MEMS& Real world Sensor/Actuator examples (DMD, Air-bag, pressure sensors). MEMS Sensors in Internet of Things (IOT), Bio-Medical Applications.
	UNIT-II: **MEMS Materials and Their Properties:** Materials (eg.Si, SiO2, SiN, Cr, Au, Ti, SU8, PMMA, Pt);Important properties: Young modulus, Poisson "sratio, density, piezo-resistive coefficients, TCR, Thermal Conductivity, Material Structure. Understanding Selection of materials based on application	**UNIT-II:** **MEMS Materials and Their Properties:** Materials (eg.Si, SiO2, SiN, Cr, Au, Ti, SU8, PMMA, Pt);Important properties: Young modulus, Poisson "sratio, density, piezo-resistive coefficients, TCR, Thermal Conductivity, Material Structure. Understanding Selection of materials based on application
	UNIT-III: **MEMS Fab Processes–1:** Understanding MEMS Processes& Process parameters for: Cleaning, Growth& Deposition, Ion Implantation &Diffusion, Annealing, Lithography. Understanding selection of Fab processes based on Applications.	**UNIT-III:** **MEMS Fab Processes–1:** Understanding MEMS Processes& Process parameters for: Cleaning, Growth& Deposition, Ion Implantation &Diffusion, Annealing, Lithography. Understanding selection of Fab processes based on Applications. **MEMS Fab Processes–2:** Understanding MEMS Processes &Process parameters for: Wet & Dry etching, Bulk & Surface Micromachining, Die, Wire & Wafer Bonding, Dicing, Packaging. Understanding selection of Fab processes based on Applications.

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	UNIT-IV: **MEMS Fab Processes–2:** Understanding MEMS Processes &Process parameters for: Wet & Dry etching, Bulk & Surface Micromachining, Die, Wire & Wafer Bonding, Dicing, Packaging. Understanding selection of Fab processes based on Applications.	**UNIT-IV:** **MEMS Devices:** Architecture, working and basic quantitative behavior of Cantilevers, Microheaters, Accelerometers, Pressure Sensors, Micromirror sin DMD, Inkjet printer-head. Understanding steps involved in Fabricating above devices.
	UNIT-V: **MEMS Devices:** Architecture, working and basic quantitative behavior of Cantilevers, Microheaters, Accelerometers, Pressure Sensors, Micromirror sin DMD, Inkjet printer-head. Understanding steps involved in Fabricating above devices.	**UNIT-V:** Advanced MEMS for Sensing and Actuation: Electromechanical effects: Piezoresistance - Piezoelectricity - Shape memory alloy-Thermal effects: Temperature coefficient of resistance - Thermo-electricity – Thermocouples – Micro fluidics: - Squeeze film damping - Surface tension and bubbles -Devices: pumps, valves, mixers -Integrated fluidic systems: BioMEMS.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Photonics	Photonics
Course Code	192VD1E06	192VD1E06
Syllabus	**UNIT-I:** **Laser Systems:** General description, Laser structure, Single mode laser theory, Excitation mechanism and working of: CO2, Nitrogen, Argonion, Excimer, X-ray, Free-electron, Dye, Nd: YAG, Alexanderite and Ti: sapphire lasers, Diode pumped solid state laser, Optical parametric oscillator (OPO) lasers. Optical amplifiers-Semiconductor optical amplifiers, Erbium doped waveguide optical amplifiers, Raman amplifiers, Fiber Lasers. Laser Applications-Lasers in Isotope separation, Laser interferometry and speckle metrology, Velocity measurements.	**UNIT-I:** **Laser Systems:** General description, Laser structure, Single mode laser theory, Excitation mechanism and working of: CO2, Nitrogen, Argonion, Excimer, X-ray, Free-electron, Dye, Nd: YAG, Alexanderite and Ti: sapphire lasers, Diode pumped solid state laser, Optical parametric oscillator (OPO) lasers. Optical amplifiers-Semiconductor optical amplifiers, Erbium doped waveguide optical amplifiers, Raman amplifiers, Fiber Lasers. Laser Applications-Lasers in Isotope separation, Laser interferometry and speckle metrology, Velocity measurements.
	UNIT-II: **Properties of laser Radiation:** Introduction, Laser line width ,Laser frequency stabilization, Beam divergence, Beam coherence, Brightness ,Focusing properties of laser radiation, Q-switching ,Methods of Q-switching: Rotating-mirror method ,Electro- optic Q-switching, Acoustic- optic Q-switching and Passive Q-switching, Mode locking, Methods of mode locking: Active and passive mode locking techniques, Frequency doubling and Phase conjugation	**UNIT-II:** **Properties of laser Radiation:** Introduction, Laser line width ,Laser frequency stabilization, Beam divergence, Beam coherence, Brightness ,Focusing properties of laser radiation, Q-switching ,Methods of Q-switching: Rotating-mirror method ,Electro- optic Q-switching, Acoustic- optic Q-switching and Passive Q-switching, Mode locking, Methods of mode locking: Active and passive mode locking techniques, Frequency doubling and Phase conjugation
	UNIT-III: **Opto -Electronic Devices-I:** Introduction, P-N junction diode,	**UNIT-III:** **Opto -Electronic Devices-I:** Introduction, P-N junction diode,

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	Carrier recombination and diffusion in P-N junction, Injection efficiency, Internal quantum efficiency, Hetero-junction, Double hetero-junction, Quantum well, Quantum dot and Super lattices; LED materials, Device configuration and efficiency.	Carrier recombination and diffusion in P-N junction, Injection efficiency, Internal quantum efficiency, Hetero-junction, Double hetero-junction, Quantum well, Quantum dot and Super lattices; LED materials, Device configuration and efficiency.
	UNIT-IV: **Opto-Electronic Devices-II:** Light extraction from LEDs, LED structures-single hetero structures, double heteros structures, Device performances and applications, Quantum well lasers; Photodiode and Avalanche photodiodes (APDs), Laser Diodes-Amplification, Feedback and oscillation, Power and efficiency, Spectral and spatial characteristics	**UNIT-IV:** **Opto-Electronic Devices-II:** Light extraction from LEDs, LED structures-single hetero structures, double heteros structures, Device performances and applications, Quantum well lasers; Photodiode and Avalanche photodiodes (APDs), Laser Diodes-Amplification, Feedback and oscillation, Power and efficiency, Spectral and spatial characteristics
	UNIT–V: **Modulation of Light:** Introduction, Birefringence, Electro-optic effect, Pockets and Kerr effects, Electro-optic Phase modulation, Electro-optic amplitude modulation, Electro-optic modulators: scanning and switching, Acousto-optic effect, Acousto-optic modulation, Raman-Nath and Bragg modulators: deflectors and spectrum analyzer, Magneto-optic effect, Faraday rotator and optical isolator. Advantages of optical modulation.	**UNIT–V:** **Optical communication systems** Modulation schemes, Analog modulation, Digital modulation, Free space communications, Fiber optical communication systems ,Operating wavelength, Emitter design, Detector design, Fiber choice , Optical amplifiers,System design considerations, Wavelength division multiplexing , Coherent systems, Solitons.

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	IoT & Its Applications	IoT & Its Applications
Course Code	192VD2E08	192VD2E08
Syllabus	**UNIT-I:** **Fundamentals of IoT:** Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum (IoT WF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects. IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards	**UNIT-I:** **Fundamentals of IoT:** Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum (IoT WF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects. IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards
	UNIT-II: **IoT Protocols:** IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: Co AP and MQTT.	**UNIT-II:** **IoT Protocols:** IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: Co AP and MQTT.
	UNIT-III: **Design And Development:** Design Methodology, Embedded	**UNIT-III:** **Design And Development:** Design Methodology, Embedded

	computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.	computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.
	UNIT-IV: **Data Analytics And Supporting Services:** Structured Vs Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning – No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web Application Framework, Django, AWS for IoT, System Management with NETCONF-YANG.	**UNIT-IV:** **Securing IoT** A Brief History of OT Security , Common Challenges in OT Security, Erosion of Network Architecture, Pervasive Legacy Systems, Insecure Operational Protocols, Modbus, DNP3 (Distributed Network Protocol), ICCP (Inter-Control Center Communications Protocol), OPC (OLE for Process Control), International Electrotechnical Commission (IEC) Protocols , Other Protocols, Device Insecurity , Security Knowledge
	UNIT-V: **Case Studies/Industrial Applications:** IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino).	**UNIT-V:** **Case Studies/Industrial Applications:** IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino).

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Program Name : M.Tech. in Computer Science and Engineering

Syllabus Revision for the Academic Year 2021-2022				
S.No	**Semester**	**Course Code**	**Course Name**	**% of content revised for the existing year**
1	I	192CS1T01	Mathematical Foundations of Computer Science	0
2	I	192CS1T02	Advanced Data Structures & Algorithms	0
3	I	192CS1E01	Big Data Analytics	0
4	I	192CS1E02	Digital Image Processing	20
5	I	192CS1E03	Advanced Operating Systems	0
6	I	192CS1E04	Advanced Computer Networks	0
7	I	192CS1E05	Internet of Things	0
8	I	192CS1E06	Object Oriented Software Engineering	0
9	I	192HS1T01	Research Methodology and IPR	0
10	I	192CS1L01	Advanced Data Structures & Algorithms Lab	0
11	I	192CS1L02	Advanced Computing Lab	0
12	II	192CS2T03	Machine learning	0
13	II	192CS2T04	MEAN Stack Technologies	0
14	II	192CS2E07	Advanced Databases and Mining	0
15	II	192CS2E08	Ad Hoc & Sensor Networks	0
16	II	192CS2E09	Soft Computing	20
17	II	192CS2E10	Cloud Computing	0
18	II	192CS2E11	Principles of computer security	20
19	II	192CS2E12	High Performance Computing	0
20	II	192CS2L03	Machine Learning with Python lab	0
21	II	192CS2L04	MEAN Stack Technologies Lab	0
22	II	192CS2P01	Mini Project with Seminar	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
23	I/II	192MC1A01// 192MC2A01	English for Research Paper Writing	0
24	I/II	191MC2A02 /192MC2A02	Disaster Management	0
25	I/II	192MC1A03// 192MC2A03	Sanskrit for Technical Knowledge	0
26	I/II	192MC1A04/1 92MC2A04	Value Education	0
27	I/II	192MC1A05/1 92MC2A05	Constitution of India	0
28	I/II	192MC1A06 /192MC2A06	Pedagogy Studies	0
29	I/II	192MC1A07 /192MC2A07	Stress Management by Yoga	0
30	I/II	192MC1A08 /192MC2A08	Personality Development through Life Enlightenment Skills	0
31	I/II	192MC1A09 /192MC2A09	Soft Skills	0
32	III	192CS3P02	Dissertation-I/ Industrial Project	0
33	III	192CS3E13	Deep Learning	0
34	III	192CS3E14	Social Network Analysis	0
35	III	192ST3O01	Repair & Rehabilitation of Structures	0
36	III	192ST3O02	Green Building Systems	0
37	III	192ST3O03	Basic Concrete Technology	0
38	III	192ST3O04	Basic Foundation Engineering	0
39	III	192PD3O01	Renewable Energy Technologies	0
40	III	192PD3O02	Hybrid Electric Vehicles	0
41	III	192PD3O03	Energy Audit and conservation Management	0
42	III	192PD3O04	Neural Networks and Fuzzy Logic	0
43	III	192PD3O05	Industrial Safety	0
44	III	192PD3O06	Composite Materials	0
45	III	192TE3O01	Energy Systems	0
46	III	192TE3O02	Fuels and Combustion	0
47	III	192TE3O03	Green Engineering Technology	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
48	III	192TE3O04	IC Engines	0
49	III	192TE3O05	Automotive Technology	0
50	III	192ES3O01	Embedded System Design	0
51	III	192ES3O02	Digital System Design	0
52	III	192ES3O03	Programming Languages for Embedded Systems	0
53	III	192ES3O04	Sensors & Actuators	0
54	III	192VD3O01	Physical Design Automation	0
55	III	192VD3O02	VLSI Technology	0
56	III	192VD3O03	Nano-electronics	0
57	III	192CS3O05	Artificial Intelligence	0
58	III	192CS3O06	Deep Learning	0
59	III	192PE3O01	Introduction to Petroleum Engineering	0
60	III	192PE3O02	Process Intensification	0
61	III	192PE3O03	Fundamentals of Liquefied Natural Gas	0
62	III	192PE3O04	Subsea Engineering	0
63	III	192PE3O05	Geology	0
64	III	192PE3O06	HSE in Petroleum Industry	0
65	IV	192CS4P03	Dissertation-II	0

Total number of courses in the academic year 2021-2022	= 56
Number of courses having revision in syllabus content >/= 20% in the academic year 2021-2022	= 3
Percentage of syllabus revision carried out in the academic year 2021-2022 = (3/65)*100	= 4.6%

Program Coordinator

Head of the Department

Head of the Department
Department of CSE
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PROGRAM STRUCTURE

I SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
192CS1T01	Mathematical Foundations of Computer Science	BSC	3	0	0	3	3
192CS1T02	Advanced Data Structures & Algorithms	PCC	3	0	0	3	3
---	Professional Elective-I	PEC	3	0	0	3	3
---	Professional Elective-II	PEC	3	0	0	3	3
192HS1T01	Research Methodology and IPR	HSMC	2	0	0	2	2
192CS1L01	Advanced Data Structures & Algorithms Lab	PCC	0	0	4	4	2
192CS1L02	Advanced Computing Lab	PCC	0	0	4	4	2
---	Audit Course-1	MC	2	0	0	2	0
		TOTAL	**16**	**0**	**8**	**24**	**18**

II SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
192CS2T03	Machine learning	PCC	3	0	0	3	3
192CS2T04	MEAN Stack Technologies	PCC	3	0	0	3	3
---	Professional Elective- III	PEC	3	0	0	3	3
---	Professional Elective- IV	PEC	3	0	0	3	3
192CS2L03	Machine Learning with Python lab	PCC	0	0	4	4	2
192CS2L04	MEAN Stack Technologies Lab	PCC	0	0	4	4	2
192CS2P01	Mini Project with Seminar	PROJ	2	0	0	2	2
---	Audit Course-2	MC	2	0	0	2	0
		TOTAL	**16**	**0**	**8**	**22**	**18**

III SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
---	Professional Elective-V	PEC	3	0	0	3	3
---	Open Elective	OEC	3	0	0	3	3
192CS3P02	Dissertation-I/ Industrial Project	PROJ	0	0	20	20	0
		TOTAL	**6**	**0**	**20**	**26**	**6**

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IV SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
192CS4P03	Dissertation-II	PROJ	0	0	32	32	26
		TOTAL	**0**	**0**	**32**	**32**	**26**

BSC: Basic Sciences Courses; HSMC: Humanities and Social Sciences including Management Courses; PCC: Professional Core Courses; PEC: Professional Elective Courses; OEC: Open Elective Courses; MC: Mandatory Courses; PROJ: Project.

Audit Course -1 & Audit Course -2 has to be chosen from the following list of courses.

S. No	Course Code		Name of the Course
	I Semester	II Semester	
01	192MC1A01	192MC2A01	English for Research Paper Writing
02	192MC1A02	192MC2A02	Disaster Management
03	192MC1A03	192MC2A03	Sanskrit for Technical Knowledge
04	192MC1A04	192MC2A04	Value Education
05	192MC1A05	192MC2A05	Constitution of India
06	192MC1A06	192MC2A06	Pedagogy Studies
07	192MC1A07	192MC2A07	Stress Management by Yoga
08	192MC1A08	192MC2A08	Personality Development through Life Enlightenment Skills
09	192MC1A09	192MC2A09	Soft Skills

Professional Elective – I (I Semester)

S.No	Course Code	Name of the Course
1	192CS1E01	Big Data Analytics
2	192CS1E02	Digital Image Processing
3	192CS1E03	Advanced Operating Systems

Professional Elective – II (I Semester)

S.No	Course Code	Name of the Course
1	192CS1E04	Advanced Computer Networks
2	192CS1E05	Internet of Things
3	192CS1E06	Object Oriented Software Engineering

Professional Elective – III (II Semester)

S.No	Course Code	Name of the Course
1	192CS2E07	Advanced Databases and Mining
2	192CS2E08	Ad Hoc & Sensor Networks
3	192CS2E09	Soft Computing

Professional Elective – IV (II Semester)

S.No	Course Code	Name of the Course
1	192CS2E10	Cloud Computing
2	192CS2E11	Principles of computer security
3	192CS2E12	High Performance Computing

Professional Elective – V (III Semester)

S.No	Course Code	Name of the Course
1	192CS3E13	Deep Learning
2	192CS3E14	Social Network Analysis
3	---	MOOCs - I*

Open Elective (III Semester)

S.No	Course Code	Name of the Course
1	---	MOOCs- II #
2	---	Courses offered by other departments in the college

***MOOCS- I:** A student should select a 12 weeks course which is not opted/ studied earlier.

 # MOOCS-II: A student should select a 12 weeks course in Engineering/ Management/ Mathematics offered by other than parent department

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Open Elective – Courses offered by Departments

S. No	Course Code	Name of the Course	Not offered to the students of the following M. Tech Specializations	Offered by Dept.
1.	192ST3O01	Repair & Rehabilitation of Structures	ST	CE
2.	192ST3O02	Green Building Systems	ST	CE
3.	192ST3O03	Basic Concrete Technology	ST	CE
4.	192ST3O04	Basic Foundation Engineering	ST	CE
5.	192PD3O01	Renewable Energy Technologies	PED	EEE
6.	192PD3O02	Hybrid Electric Vehicles	PED	EEE
7.	192PD3O03	Energy Audit and conservation Management	PED	EEE
8.	192PD3O04	Neural Networks and Fuzzy Logic	PED	EEE
9.	192PD3O05	Industrial Safety	PED	EEE
10.	192PD3O06	Composite Materials	PED	EEE
11.	192TE3O01	Energy Systems	TE	ME
12.	192TE3O02	Fuels and Combustion	TE	ME
13.	192TE3O03	Green Engineering Technology	ST, TE	ME
14.	192TE3O04	IC Engines	TE	ME
15.	192TE3O05	Automotive Technology	TE	ME
16.	192ES3O01	Embedded System Design	ES	ECE
17.	192ES3O02	Digital System Design	VLSID	ECE
18.	192ES3O03	Programming Languages for Embedded Systems	ES	ECE
19.	192ES3O04	Sensors & Actuators	ES	ECE
20.	192VD3O01	Physical Design Automation	VLSID	ECE
21.	192VD3O02	VLSI Technology	VLSID	ECE
22.	192VD3O03	Nano-electronics	VLSID	ECE
23.	192CS3O01	Python Programming (CSE)	CSE, SE	CSE
24.	192CS3O02	Principles of Cyber Security	CSE	CSE
25.	192CS3O03	Internet of Things	CSE, SE	CSE
26.	192CS3O04	Machine Learning	CSE, SE	CSE
27.	192CS3O05	Artificial Intelligence	SE	IT
28.	192CS3O06	Deep Learning	CSE, SE	IT
29.	192PE3O01	Introduction to Petroleum Engineering	PE	PT
30.	192PE3O02	Process Intensification	PE	PT
31.	192PE3O03	Fundamentals of Liquefied Natural Gas	PE	PT
32.	192PE3O04	Subsea Engineering	PE	PT
33.	192PE3O05	Geology	PE, ST	PT
34.	192PE3O06	HSE in Petroleum Industry	PE	PT

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DIGITAL IMAGE PROCESSING
(Professional Elective-I)

I Semester | **L T P C**
Course Code: 192CS1E02 | **3 0 0 3**

Course Objectives:

COB 1: To enable the students to learn the basic principles of digital image processing.
COB 2: To make the students implement algorithms that perform basic image processing.
COB 3: To facilitate the students to write algorithms for advanced image analysis.
COB 4: To Assess the performance of image processing algorithms and systems

Course Outcomes:
At the end of the Course, Student will be able to:

CO 1: Demonstrate the components of image processing.
CO 2: Summarize various filtration techniques.
CO 3: Apply image compression techniques to real time applications.
CO 4: Discuss the concepts of wavelet transforms.
CO 5: Analyze the concept of morphological image processing.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO 1 (K5)	PO 2 (K4)	PO 3 (K5)	PO 4 (K3)	PO 5 (K3)	PO 6 (K4)	PO 7 (K6)	PO 8 (K2)	PO 9 (K2)	PO 10 (K2)	PO11 (K4)
CO1 (K2)	-	1	-	2	-	-	-	-	-	-	-
CO2 (K2)	2	1	-	2	-	-	-	-	-	-	-
CO3 (K3)	-	-	1	3	-	-	-	-	-	-	-
CO4 (K2)	-	-	-	2	-	-	-	-	-	-	-
CO5 (K4)	-	-	-	3	3	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1 (K4)	PSO 2 (K4)
CO1 (K2)	-	-
CO2 (K2)	1	-
CO3 (K3)	-	2
CO4 (K2)	3	-
CO5 (K4)	3	-

UNIT-I:
Introduction: Fundamental steps in Image Processing System, Components of Image Processing System, Elements of Visual Perception, Image Sensing and acquisition, Image sampling & Quantization, Basic Relationship between pixels.
Image Enhancement Techniques: Spatial Domain Methods: Basic grey level transformation, Histogram equalization, Image subtraction, image averaging.

UNIT-II:

Spatial filtering: Smoothing, sharpening filters, Laplacian filters, Frequency domain filters, Smoothing and sharpening filters, Homomorphism is filtering. Image Restoration & Reconstruction: Model of Image Degradation/restoration process, Noise models, Spatial filtering, Inverse filtering, Minimum mean square Error filtering, constrained least square filtering, Geometric mean filter, Image reconstruction from projections. Color Fundamentals, Color Models, Color Transformations.

UNIT-III:

Image Compression: Redundancies- Coding, Interpixel, Psycho visual; Fidelity, Source and Channel Encoding, Elements of Information Theory; Loss Less and Lossy Compression; Run length coding, Differential encoding, DCT, Vector quantization, Entropy coding, LZW coding; Image Compression Standards-JPEG, JPEG 2000, MPEG; Video compression.

UNIT-IV:

Wavelet Based Image Compression: Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT), Continuous, Wavelet Transform, Fast Wavelet Transform, 2-D wavelet Transform, JPEG-2000 encoding.

UNIT-V:

Image Segmentation: Discontinuities, Edge Linking and boundary detection, Thresholding, Region Based Segmentation, Watersheds; Introduction to morphological operations; binary morphology- erosion, dilation, opening and closing operations, applications; basic gray-scale morphology operations; Feature extraction; Classification; Object recognition.
Digital Image Watermarking: Introduction, need of Digital Image Watermarking, applications of watermarking in copyright protection and Image quality analysis.

Text Books:

1. Digital Image Processing, Gonzalez, R.C. and. Woods R.E, 2nd Edition, Person Education,2009.

Reference Books:

1. Digital Image Processing, Pratt, W. K, John Wiley (2001).
2. Digital Image Processing, Jayaraman, S., Veerakumar, T. and Esakkiranjan, S. Tata McGraw-Hill,2009.
3. Digital Image Processing with MATLAB and LABVIEW, Vipul Si.

Web Links:

1. http://nptel.ac.in/courses/117105079/
2. http://freevideolectures.com/Course/2316/Digital-Image-Processing-IIT-Kharagpur
3. https://www.cs.nmt.edu/~ip/lectures.html
4. https://www.robotix.in/tutorial/imageprocessing/basicIp/
5. http://nptel.ac.in/courses/117105135/

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Reference Book:

1. Network Security Essentials, Principles and Practices, William Stallings, Pearson.

Web Links

1. https://nptel.ac.in/courses/106105031/
2. https://nptel.ac.in/courses/106105162/
3. https://www.udacity.com/course/network-security--ud199

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SOFT COMPUTING
(Professional Elective-III)

II Semester	**L**	**T**	**P**	**C**
Course Code: 192CS2E09	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.

COB 2: To implement soft computing based solutions for real-world problems.

COB 3: To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.

COB 4: To provide student a hand-on experience on MATLAB to implement various strategies.

Course Outcomes:

At the end of this course the student will be able to:

CO1: Elaborate fuzzy logic and reasoning to handle uncertainty in engineering problems.

CO2: Make use of genetic algorithms to combinatorial optimization problems.

CO3: Distinguish artificial intelligence techniques, including search heuristics, knowledge representation, planning and reasoning.

CO4: Formulate and apply the principles of self-adopting and self organizing neuro fuzzy inference systems.

CO5: Evaluate and compare solutions by various soft computing approaches for a given problem.

Mapping of course outcomes with program outcomes:

CO / PO	PO 1 (K5)	PO 2 (K4)	PO 3 (K5)	PO 4 (K3)	PO 5 (K3)	PO 6 (K4)	PO 7 (K6)	PO 8 (K2)	PO 9 (K2)	PO 10 (K2)	PO 11 (K4)
CO1 (K2)	2	2	-	-	-	-	-	-	-	-	-
CO2 (K3)	2	2	-	1	-	-	-	-	-	-	-
CO3 (K2)	1	2	1	2	-	-	-	-	-	-	-
CO4 (K4)	2	1	1	1	-	-	-	-	-	-	-
CO5 (K3)	2	2	1	3	-	-	-	-	-	-	2

Mapping of Course Outcomes with Program Specific Outcomes:

CO / PSO	PSO 1(K4)	PSO 2(K4)
CO1 (K2)	1	2
CO2 (K4)	-	2
CO3 (K2)	2	2
CO4 (K4)	2	2
CO5 (K3)	1	-

UNIT-I:

Fuzzy Set Theory:

Introduction to Neuro, Fuzzy and Soft Computing, Fuzzy Sets, Basic function and Terminology, Set-theoretic Operations, Member Function Formulation and arameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations, Fuzzy If-Then

Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models, Input Space Partitioning and Fuzzy Modeling.

UNIT-II:

Optimization:

Derivative based Optimization, Descent Methods, and The Method of Steepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms, Simulated Annealing, and Random Search, Downhill Simplex Search.

UNIT-III:

Artificial Intelligence:

Introduction, Knowledge Representation, Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning Under Uncertainty Basic knowledge Representation Issues Knowledge acquisition, Heuristic Search: Techniques for Heuristic search Heuristic Classification State Space Search: Strategies Implementation of Graph Search based on Recursion Patent-directed Search Production System and Learning.

UNIT-IV:

Neuro Fuzzy Modeling:

Adaptive Neuro-Fuzzy Inference Systems, Architecture Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN Coactive Neuro Fuzzy Modeling, Framework Neuron Functions for Adaptive Networks Neuro Fuzzy Spectrum.

UNIT-V:

Applications Of Computational Intelligence:

Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction, Soft Computing for Coloripe Prediction.

Text Books:

1. "Neuro-Fuzzy and Soft Computing", J.S.R.Jang, C.T.Sun and E.Mizutani, PHI, 2004, Pearson Education 2004.
2. Artificial Intelligence by Saroj Koushik, Cengage Learning.
3. "Artificial Intelligence and Intelligent Systems", N.P.Padhy, Oxford University Press, 2006.

Reference Books:

1. Artificial Intelligence, Second Edition, Elaine Rich & Kevin Knight, Tata McGraw Hill Publishing Comp., New Delhi, 2006.
2. "Fuzzy Logic with Engineering Applications", Timothy J.Ross, McGraw-Hill, 1997.

Web Links:

1. https://nptel.ac.in/courses/106105173/
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105173/lec1.pdf
3. https://www.coursera.org/courses?query=neural%20networks

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PRINCIPLES OF COMPUTER SECURITY
(Professional Elective-IV)

II Semester	**L**	**T**	**P**	**C**
Course Code: 192CS2E11	**3**	**0**	**0**	**3**

Course Objectives:
In the course the student will learn

- COB 1: To Provide an overview of modern cryptographic theories and techniques, mainly focusing on their application into real systems.
- COB 2: To teach the awareness on Database and Cloud Security, Malicious Software, Denial-of-Service Attacks, Software Security, Operating System Security, Wireless Network Security and mobile device security.

Course Outcomes:
After the completion of the course, student will be able to

- CO 1: Describe the key security requirements of confidentiality, integrity, and availability, types of security threats and attacks and summarize the functional requirements for computer security.
- CO 2: Explain the basic operation of symmetric block encryption algorithms, use of secure hash functions for message authentication, digital signature mechanism.
- CO 3: Discuss the issues involved and the approaches for user authentication and explain how access control fits into the broader context that includes authentication, authorization, and audit.
- CO 4: Explain the basic concept of a denial-of-service attack, nature of flooding attacks, distributed denial-of-service attacks and describe how computer security vulnerabilities are a result of poor programming practices.
- CO 5: List the steps used to secure the base operating system, specific aspects of securing Unix/Linux systems, Windows systems, and security in virtualized systems and describe the security threats and countermeasures for wireless networks.

Mapping of Course Outcomes with Program Outcomes

CO / PO	PO 1 (K5)	PO 2 (K4)	PO 3 (K5)	PO 4 (K3)	PO 5 (K3)	PO 6 (K4)	PO 7 (K6)	PO 8 (K2)	PO 9 (K2)	PO 10 (K2)	PO 11 (K4)
CO1 (K3)	3	2	2	1	3	3	2	-	-	-	-
CO2 (K3)	3	2	2	1	3	3	2	-	-	-	-
CO3 (K3)	3	2	1	1	3	3	2	-	-	-	-
CO4 (K3)	2	1	-	-	2	2	3	-	-	-	-
CO5 (K3)	-	3	3	3	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K4)	PSO 2(K4)
CO1 (K3)	3	3
CO2 (K3)	2	2
CO3 (K3)	3	3
CO4 (K3)	2	2
CO5 (K3)	3	3

UNIT-I:

Introduction:

Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, Fundamental Security Design Principles, Attack Surfaces and Attack Trees, Computer Security Strategy. Cryptographic Tools: Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random and Pseudorandom Numbers.

UNIT-II:

User Authentication:

Electronic User Authentication Principles, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication. Access Control:, Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, UNIX File Access Control, Role-Based Access Control, Attribute-Based Access Control, Identity, Credential, and Access Management, Trust Frameworks.

UNIT-III:

Database and Cloud Security:

The Need for Database Security, Database Management Systems, Relational Databases, Sql Injection Attacks, Database Access Control, Database Encryption, Cloud Computing, Cloud Security Risks And Countermeasures, Data Protection In The Cloud, Cloud Security As A Service. Malicious Software: Types of Malicious Software (Malware), Advanced Persistent Threat, Propagation, Infected Content, Viruses, Propagation, Vulnerability Exploit, Worms, Propagation, Social Engineering, Spam E-Mail, Trojans, Payload, System Corruption, Payload, Attack Agent, Zombie, Bots, Payload, Information Theft, Key loggers, Phishing, Spyware, Payload, Stealthing, Backdoors, Root kits, Countermeasures.

UNIT-IV:

Denial-of-Service Attacks:

Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Reflector and Amplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to a Denial-of-Service Attack. Software Security: Software Security Issues, Handling Program Input, Writing Safe Program Code, Interacting with the Operating System and Other Programs.

UNIT V: Operating System Security: Introduction To Operating System Security, System Security Planning, Operating Systems Hardening, Application Security, Security Maintenance, Linux/Unix Security, Windows Security, Virtualization Security. Wireless **Network Security:** Wireless Security, Mobile Device Security, IEEE 802.11Wireless LAN Overview, IEEE 802.11i Wireless LAN Security.

Text Book:

1. Computer Security: Principles and Practices, 3e, William Stallings, Lawrie Brown, Pearson

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Syllabus revision Index 2021-2022

S.No	Name of the course	Percentage of syllabus change
1	Digital Image Processing	20%
2	Soft Computing	20%
3	Principles of computer security	20%

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Digital Image Processing	Digital Image Processing
Course Code	172CO2E06	192CS1E02
Syllabus	**UNIT-I:** **Introduction:** Fundamental steps in Image Processing System, Components of Image Processing System, Elements of Visual Perception, Image Sensing and acquisition, Image sampling & Quantization, Basic Relationship between pixels. **Image Enhancement Techniques:** Spatial Domain Methods: Basic grey level transformation, Histogram equalization.	**UNIT-I:** **Introduction:** Fundamental steps in Image Processing System, Components of Image Processing System, Elements of Visual Perception, Image Sensing and acquisition, Image sampling & Quantization, Basic Relationship between pixels. **Image Enhancement Techniques:** Spatial Domain Methods: Basic grey level transformation, Histogram equalization, Image subtraction, image averaging.
	UNIT-II: **Spatial filtering:** Smoothing, sharpening filters, Laplacian filters, Frequency domain filters, Smoothing and sharpening filters, Homomorphism is filtering. Image Restoration & Reconstruction: Model of Image Degradation/restoration process, Noise models, Spatial filtering, Inverse filtering, Minimum mean square Error filtering, constrained least square filtering.	**UNIT-II:** **Spatial filtering:** Smoothing, sharpening filters, Laplacian filters, Frequency domain filters, Smoothing and sharpening filters, Homomorphism is filtering. Image Restoration & Reconstruction: Model of Image Degradation/restoration process, Noise models, Spatial filtering, Inverse filtering, Minimum mean square Error filtering, constrained least square filtering, Geometric mean filter, Image reconstruction from projections. Color Fundamentals, Color Models, Color Transformations
	UNIT-III: **Image Compression:** Redundancies-Coding, Interpixel, Psycho visual; Fidelity, Source and Channel Encoding, Elements of Information	**UNIT-III:** **Image Compression:** Redundancies-Coding, Interpixel, Psycho visual; Fidelity, Source and Channel Encoding, Elements of Information Theory; Loss

	Theory; Loss Less and Lossy Compression; Run length coding, Differential encoding, DCT, Vector quantization.	Less and Lossy Compression; Run length coding, Differential encoding, DCT, Vector quantization, Entropy coding, LZW coding; Image Compression Standards-JPEG, JPEG 2000, MPEG; Video compression.
	UNIT-IV: **Wavelet Based Image Compression:** Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT), Continuous, Wavelet Transform, Fast Wavelet Transform.	**UNIT-IV:** **Wavelet Based Image Compression:** Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT), Continuous, Wavelet Transform, Fast Wavelet Transform, 2-D wavelet Transform, JPEG-2000 encoding.
	UNIT-V: **Image Segmentation:** Discontinuities, Edge Linking and boundary detection, Thresholding, Region Based Segmentation, Watersheds; Introduction to morphological operations; binary morphology- erosion, dilation, opening and closing operations, applications; basic grayscale morphology operations; Feature extraction.	**UNIT-V:** **Image Segmentation:** Discontinuities, Edge Linking and boundary detection, Thresholding, Region Based Segmentation, Watersheds; Introduction to morphological operations; binary morphology- erosion, dilation, opening and closing operations, applications; basic grayscale morphology operations; Feature extraction; Classification; Object recognition. Digital Image Watermarking: Introduction, need of Digital Image Watermarking, applications of watermarking in copyright protection and Image quality analysis.

Signature of the course coordinator

Signature of the HOD

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1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Soft Computing	Soft Computing
Course Code	192CS2E09	192CS2E09
	UNIT-I: **Fuzzy Set Theory:** Introduction to Neuro, Fuzzy and Soft Computing, Fuzzy Sets, Basic function and Terminology, Set-theoretic Operations, Member Function Formulation and arameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models.	**UNIT-I:** **Fuzzy Set Theory:** Introduction to Neuro, Fuzzy and Soft Computing, Fuzzy Sets, Basic function and Terminology, Set-theoretic Operations, Member Function Formulation and arameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models, Input Space Partitioning and Fuzzy Modeling.
Syllabus	**UNIT-II:** **Optimization:** Derivative based Optimization, Descent Methods, and The Method of Steepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms.	**UNIT-II:** **Optimization:** Derivative based Optimization, Descent Methods, and The Method of Steepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms, Simulated Annealing, and Random Search, Downhill Simplex Search.
	UNIT-III: **Artificial Intelligence:** Introduction, Knowledge Representation, Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic	**UNIT-III:** **Artificial Intelligence:** Introduction, Knowledge Representation, Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic

	Reasoning Under Uncertainty Basic knowledge Representation Issues Knowledge acquisition.	Reasoning Under Uncertainty Basic knowledge Representation Issues Knowledge acquisition, Heuristic Search: Techniques for Heuristic search Heuristic Classification State Space Search: Strategies Implementation of Graph Search based on Recursion Patent-directed Search Production System and Learning.
	UNIT-IV: **Neuro Fuzzy Modeling:** Adaptive Neuro-Fuzzy Inference Systems,Architecture Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN Coactive Neuro Fuzzy Modeling.	**UNIT-IV:** **Neuro Fuzzy Modeling:** Adaptive Neuro-Fuzzy Inference Systems, Architecture Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN Coactive Neuro Fuzzy Modeling, Framework Neuron Functions for Adaptive Networks Neuro Fuzzy Spectrum.
	UNIT-V: **Applications of Computational Intelligence:** Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction.	**UNIT-V:** **Applications of Computational Intelligence:** Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction, Soft Computing for Coloripe Prediction.

Signature of the Course Coordinator

Signature of the HOD

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Department of Computer Science and Engineering

1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Principles of computer security	Principles of computer security
Course Code	192CS2E11	192CS2E11
	UNIT-I: **Introduction:** Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements Fundamental Security Design Principles, Attack Surfaces and Attack Trees, Computer Security Strategy. Cryptographic Tools: Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption.	**UNIT-I:** **Introduction:** Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, Fundamental Security Design Principles, Attack Surfaces and Attack Trees, Computer Security Strategy. Cryptographic Tools: Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random and Pseudorandom Numbers.
Syllabus	**UNIT-II:** **User Authentication:** Electronic User Authentication Principles, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication. Access Control: Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, UNIX File Access Control.	**UNIT-II:** **User Authentication:** Electronic User Authentication Principles, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication. Access Control: Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, UNIX File Access Control, Role-Based Access Control, Attribute-Based Access Control, Identity, Credential, and Access Management, Trust Frameworks.

	UNIT-III: **Database and Cloud Security:** The Need for Database Security, Database Management Systems, Relational Databases, SQL Injection Attacks, Database Access Control, Database Encryption, Cloud Computing, Cloud Security Risks And Countermeasures, Data Protection In The Cloud, Cloud Security As A Service. Malicious Software: Types of Malicious Software (Malware), Advanced Persistent Threat, Propagation, Infected Content, Viruses, Propagation, Vulnerability Exploit, Worms, Propagation, Social Engineering, Spam E-Mail, Trojans, Payload, System Corruption, Payload.	**UNIT-III:** **Database and Cloud Security:** The Need for Database Security, Database Management Systems, Relational Databases, SQL Injection Attacks, Database Access Control, Database Encryption, Cloud Computing, Cloud Security Risks And Countermeasures, Data Protection In The Cloud, Cloud Security As A Service. Malicious Software: Types of Malicious Software (Malware), Advanced Persistent Threat, Propagation, Infected Content, Viruses, Propagation, Vulnerability Exploit, Worms, Propagation, Social Engineering, Spam E-Mail, Trojans, Payload, System Corruption, Payload, Attack Agent, Zombie, Bots, Payload, Information Theft, Key loggers, Phishing, Spyware, Payload, Stealthing, Backdoors, Root kits, Countermeasures.
	UNIT-IV: **Denial-of-Service Attacks:** Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks,Application-Based Bandwidth Attacks, Reflector and Amplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to a Denial-of-Service Attack.	**UNIT-IV:** **Denial-of-Service Attacks:** Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks,Application-Based Bandwidth Attacks, Reflector and Amplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to a Denial-of-Service Attack. Software Security:Software Security Issues, Handling Program Input, Writing Safe Program Code, Interacting with the Operating System and Other Programs.
	UNIT-V: **Operating System Security:** Introduction To Operating System Security, System Security Planning, Operating Systems Hardening, Application Security, Security Maintenance, Linux/Unix Security,	**UNIT-V:** **Operating System Security:** Introduction To Operating System Security, System Security Planning, Operating Systems Hardening, Application Security, Security Maintenance, Linux/Unix Security,

	Windows Security, Virtualization Security.	Windows Security, Virtualization Security. Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11Wireless LAN Overview, IEEE 802.11i Wireless LAN Security.

Signature of the Course Coordinator

Signature of the HOD

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Recognised by UGC under sections 2(f) and 12(B) of UGC Act, 1956
Aditya Nagar, ADB Road, Surampalem - 533437, Near Kakinada, E.G.Dt., Ph:99498 76662

Program Name : M.Tech. in Petroleum Engineering

Syllabus Revision for the Academic Year 2021-2022

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
1	I	192PE1T01	Offshore Drilling.	0
2	I	192PE1T02	Fundamentals of Petroleum Geology and Reservoir Engineering. (NON-PE stream)	0
3	I	192PE1T03	Reservoir Stimulation (PE stream)	0
4	I	192PE1T04	Petroleum Well Drilling and Production Engineering. (NON-PE stream)	0
5	I	192PE1E01	Advanced Numerical Methods and Applied	0
6	I	192PE1E02	CBMand Shale Gas Engineering	0
7	I	192PE1E03	Transportation of Oil and Gas	0
8	I	192PE1E04	Advanced Well Logging Techniques and Well Testing Analysis	20
9	I	192HS1T01	Research Methodology and IPR	0
10	I	192PE1L01	Advanced Numerical Methods and	0
11	I	192PE1L02	Drilling Simulation Laboratory	0
12	II	192PE2T05	Artificial Lift Techniques	0
13	II	192PE2T06	Reservoir Modeling and Simulation	0
14	II	192PE2E05	Advanced EOR Techniques	0
15	II	192PE2E06	Advanced Well Completions	20
16	II	192PE2E07	Flow Assurance	0
17	II	192PE2E08	Advanced Horizontal Well Technology	0
18	II	192PE2L03	Reservoir Simulation Laboratory	0
19	II	192PE2L04	Flow Assurance Laboratory	0
20	II	192PE2P01	Mini Project with Seminar	0
21	I & II	192MC1A01/192MC2A01	English for Research Paper Writing	0
22	I & II	192MC1A02/192MC2A02	Disaster Management	0
23	I & II	192MC1A03/192MC2A03	Sanskrit for Technical Knowledge	0
24	I & II	192MC1A04/192MC2A04	Value Education	0
25	I & II	192MC1A05/192MC2A05	Constitution of India	0
26	I & II	192MC1A06/192MC2A06	Pedagogy Studies	0
27	I & II	192MC1A07/192MC2A07	Stress Management by Yoga	0
28	I & II	192MC1A08/192MC2A08	Personality Development through Life Enlightenment Skills	0
29	I & II	192MC1A09/192MC2A09	Soft Skills	0
30	III	192ST3O01	Repair & Rehabilitation of Structures	0
31	III	192ST3O02	Green Building Systems	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
32	III	192ST3O03	Basic Concrete Technology	0
33	III	192ST3O04	Basic Foundation Engineering	0
34	III	192PD3O01	Renewable Energy Technologies	0
35	III	192PD3O02	Hybrid Electric Vehicles	0
36	III	192PD3O03	Energy Audit and conservation Management	0
37	III	192PD3O04	Neural Networks and Fuzzy Logic	0
38	III	192PD3O05	Industrial Safety	0
39	III	192PD3O06	Composite Materials	0
40	III	192TE3O01	Energy Systems	0
41	III	192TE3O02	Fuels and Combustion	0
42	III	192TE3O03	Green Engineering Technology	0
43	III	192TE3O04	IC Engines	0
44	III	192TE3O05	Automotive Technology	0
45	III	192ES3O01	Embedded System Design	0
46	III	192ES3O02	Digital System Design	0
47	III	192ES3O03	Programming Languages for	0
48	III	192ES3O04	Sensors & Actuators	0
49	III	192VD3O01	Physical Design Automation	0
50	III	192VD3O02	VLSI Technology	0
51	III	192VD3O03	Nano-electronics	0
52	III	192CS3O01	Python Programming (CSE)	0
53	III	192CS3O02	Principles of Cyber Security	0
54	III	192CS3O03	Internet of Things	0
55	III	192CS3O04	Machine Learning	0
56	III	192CS3O05	Artificial Intelligence	0
57	III	192CS3O06	Deep Learning	0
58	III	192PE3O01	Introduction to Petroleum Engineering	0
59	III	192PE3O02	Process Intensification	0
60	III	192PE3O03	Fundamentals of Liquefied Natural Gas	0
61	III	192PE3O04	Subsea Engineering	0
62	III	192PE3O05	Geology	0
63	III	192PE3O06	HSE in Petroleum Industry	0
64	III	192PE3P02	Dissertation-I/ Industrial Project	0
65	IV	192PE4P03	Dissertation-II	0

Total number of courses in the academic year 2021-2022	= 65
Number of courses having revision in syllabus content >/= 20% in the academic year 2021-2022	= 2
Percentage of syllabus revision carried out in the academic year 2021-2022 = (2/65)*100	= 3.07%

Program Coordinator

Head of the Department

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21-22

PROGRAM STRUCTURE

I SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
192PE1T01	Offshore Drilling.	PCC	3	0	0	3	3
192PE1T02	Fundamentals of Petroleum Geology and Reservoir Engineering. (NON-PE stream)						
192PE1T03	Reservoir Stimulation (PE stream)	PCC	3	0	0	3	3
192PE1T04	Petroleum Well Drilling and Production Engineering. (NON-PE stream)						
---	Professional Elective – I	PEC	3	0	0	3	3
---	Professional Elective – II	PEC	3	0	0	3	3
192HS1T01	Research Methodology and IPR	HSMC	2	0	0	2	2
192PE1L01	Advanced Numerical Methods and Applied Statistics Laboratory (MATLAB Based)	PCC	0	0	4	4	2
192PE1L02	Drilling Simulation Laboratory	PCC	0	0	4	4	2
---	Audit Course 1	MC	2	0	0	2	0
		TOTAL	16	0	8	24	18

II SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
192PE2T05	Artificial Lift Techniques	PCC	3	0	0	3	3
192PE2T06	Reservoir Modeling & Simulation	PCC	3	0	0	3	3
---	Professional Elective – III	PEC	3	0	0	3	3
---	Professional Elective – IV	PEC	3	0	0	3	3
192PE2L03	Reservoir Simulation Laboratory	PCC	0	0	4	4	2
192PE2L04	Flow Assurance Laboratory	PCC	0	0	4	4	2
192PE2P01	Mini Project with Seminar	PROJ	2	-	-	2	2
---	Audit Course 2	MC	2	0	0	2	0
		TOTAL	16	0	8	24	18

III SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
---	Professional Elective -V	PEC	3	0	0	3	3
---	Open Elective	OEC	3	0	0	3	3
192PE3P02	Dissertation-I/ Industrial Project	PROJ	0	0	20	20	0
		TOTAL	6	0	20	26	6

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IV SEMESTER

Course Code	Name of the Course	Course Component	Total Number of contact hours				Credits (C)
			Lecture (L)	Tutorial (T)	Practice (P)	Total Hours	
192PE4P03	Dissertation-II	PROJ	0	0	32	32	26
		TOTAL	0	0	32	32	26

BSC: Basic Sciences Courses; HSMC: Humanities and Social Sciences including Management Courses; PCC: Professional Core Courses; PEC: Professional Elective Courses; OEC: Open Elective Courses; MC: Mandatory Courses; PROJ: Project.

Audit Course-1 & Audit Course-2 has to be chosen from the following list of courses.

S. No	Course Code		Name of the Course
	I Semester	II Semester	
1	192MC1A01	192MC2A01	English for Research Paper Writing
2	192MC1A02	192MC2A02	Disaster Management
3	192MC1A03	192MC2A03	Sanskrit for Technical Knowledge
4	192MC1A04	192MC2A04	Value Education
5	192MC1A05	192MC2A05	Constitution of India
6	192MC1A06	192MC2A06	Pedagogy Studies
7	192MC1A07	192MC2A07	Stress Management by Yoga
8	192MC1A08	192MC2A08	Personality Development through Life Enlightenment Skills
9	192MC1A09	192MC2A09	Soft Skills

Professional Elective – I (I Semester)			Professional Elective – II (I Semester)		
S.No	Course Code	Name of the Course	S.No	Course Code	Name of the Course
1	192PE1E01	Advanced Numerical Methods and Applied Statistics	1	192PE1E03	Transportation of Oil and Gas
2	192PE1E02	CBM& Shale Gas Engineering	2	192PE1E04	Advanced Well Logging Techniques & Well Testing Analysis
Professional Elective – III (II Semester)			**Professional Elective – IV (II Semester)**		
S.No	Course Code	Name of the Course	S.No	Course Code	Name of the Course
1	192PE2E05	Advanced EOR Techniques	1	192PE2E07	Flow Assurance
2	192PE2E06	Advanced Well Completions	2	192PE2E08	Advanced Horizontal Well Technology
Professional Elective – V (III Semester)			**Open Elective (III Semester)**		
S.No	Course Code	Name of the Course	S.No	Course Code	Name of the Course
1	—	MOOCs-I*	1	---	MOOCs- II #
			2	—	Courses offered by other departments in the college

***MOOCS- I:** A student should select a 12 weeks course which is not opted/ studied earlier.

 # MOOCS- II: A student should select a 12 weeks course in Engineering/ Management/ Mathematics offered by other than parent department.

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Open Elective – Courses offered by Departments

S. No	Course Code	Name of the Course	Not offered to the students of the following M. Tech Specializations	Offered by Dept.
1.	192ST3O01	Repair & Rehabilitation of Structures	ST	CE
2.	192ST3O02	Green Building Systems	ST	CE
3.	192ST3O03	Basic Concrete Technology	ST	CE
4.	192ST3O04	Basic Foundation Engineering	ST	CE
5.	192PD3O01	Renewable Energy Technologies	PED	EEE
6.	192PD3O02	Hybrid Electric Vehicles	PED	EEE
7.	192PD3O03	Energy Audit and conservation Management	PED	EEE
8.	192PD3O04	Neural Networks and Fuzzy Logic	PED	EEE
9.	192PD3O05	Industrial Safety	PED	EEE
10.	192PD3O06	Composite Materials	PED	EEE
11.	192TE3O01	Energy Systems	TE	ME
12.	192TE3O02	Fuels and Combustion	TE	ME
13.	192TE3O03	Green Engineering Technology	ST, TE	ME
14.	192TE3O04	IC Engines	TE	ME
15.	192TE3O05	Automotive Technology	TE	ME
16.	192ES3O01	Embedded System Design	ES	ECE
17.	192ES3O02	Digital System Design	VLSID	ECE
18.	192ES3O03	Programming Languages for Embedded Systems	ES	ECE
19.	192ES3O04	Sensors & Actuators	ES	ECE
20.	192VD3O01	Physical Design Automation	VLSID	ECE
21.	192VD3O02	VLSI Technology	VLSID	ECE
22.	192VD3O03	Nano-electronics	VLSID	ECE
23.	192CS3O01	Python Programming (CSE)	CSE, SE	CSE
24.	192CS3O02	Principles of Cyber Security	CSE	CSE
25.	192CS3O03	Internet of Things	CSE, SE	CSE
26.	192CS3O04	Machine Learning	CSE, SE	CSE
27.	192CS3O05	Artificial Intelligence	SE	IT
28.	192CS3O06	Deep Learning	CSE, SE	IT
29.	192PE3O01	Introduction to Petroleum Engineering	PE	PT
30.	192PE3O02	Process Intensification	PE	PT
31.	192PE3O03	Fundamentals of Liquefied Natural Gas	PE	PT
32.	192PE3O04	Subsea Engineering	PE	PT
33.	192PE3O05	Geology	PE, ST	PT
34.	192PE3O06	HSE in Petroleum Industry	PE	PT

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ADVANCED WELL COMPLETIONS

(Professional Elective- III)

II Semester **L T P C**
Course Code:192PE2E06 **3 0 0 3**

Course Objectives:

- COB 1: To gain Knowledge on well completion and their latest advantages.
- COB 2: To understand intricacies of well completions.
- COB 3: To help students gain Information about completion equipment and their relation.
- COB 4: To get knowledge of different types of well completions.
- COB 5: To impart knowledge on installation of different types of well completions.

Course Outcomes:

At the end of the course, the student will be able to:

- CO 1: Understand about Basic well completion techniques and Sand Control
- CO 2: Select of Equipment for Well Operations, Material Selection and Tubing Stress Analysis
- CO 3: Identify different well completions equipment for various types of Wells
- CO 4: Recognise different well completion techniques required for different Equipments
- CO 5: Familiarize with installation procedure for different well completion techniques.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO 1 (K5)	PO 2 (K4)	PO 3 (K5)	PO 4 (K3)	PO 5 (K3)	PO 6 (K4)	PO 7 (K6)	PO 8 (K2)	PO 9 (K2)	PO 10 (K2)	PO11 (K4)
CO1 (K2)	3	2	1	2	-	-	-	-	-	-	-
CO2 (K2)	2	2	1	2	-	1	-	-	-	-	1
CO3 (K3)	3	2	1	2	-	-	-	-	-	-	-
CO4 (K2)	3	2	-	1	1	-	-	-	-	.-	1
CO5 (K3)	2	2	-	2	1	-	1	-	1	1	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1 (K3)	PSO 2 (K2)	PSO 3 (K4)	PSO 4(K3)
CO1 (K2)	3	-	1	-
CO2 (K2)	2	-	-	-
CO3 (K3)	2	1	-	-
CO4 (K2)	2	-	-	1
CO5 (K3)	3	2	3	-

UNIT-I:

Basics of Reservoir Completion: Inflow Performance Relationship, Perforating, Hydraulic Fracturing, Acid Fracturing.

Sand Control: Rock Strength, Sand control Prediction, Sand production mitigation, Sand control screens, Gravel Packing, Chemical sand consolidation.

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UNIT-II:

Life of Well Operations: Types and methods of Intervening, Impact on Completion Design. Tubing well performance, Multiphase flow & tubing performance, Flow predictions, Temperature prediction and Control, Packer fluids, Production & Injection well sizing.

Material Selection: Down hole Corrosion, Metallurgy Selection, Corrosion Inhibition, Seals, Control Lines and encapsulation, Coatings and liners

Tubing Stress Analysis: Stress, Strain and Grades, Axial Loads, Burst, Collapse, Triaxial Analysis, Safety and design Factors, Load Cases, Tubing Connections

UNIT -III:

Completion Equipment:

On-land and subsea Christmas trees; Subsurface safety Valves, Packers, Expansion devices and anchor latches, Landing nipples, locks and sleeves, Mandrels and gauges, Capillary lines and cable clamps, Loss control and reservoir isolation valves, Crossovers, Flow couplings, Modules,

UNIT-IV:

Well Completion Techniques:

Deep water Completions. HPHT Completions, Completions with down hole flow control, Multilateral Completions, Dual Completions, Multipurpose Completions, Underbalanced completions, Coiled tubing and insert completions, Completions for Heavy oil and steam injection, Completions for Coal Bed Methane.

UNIT-V:

Well completion: Types of wells- Completion functions- Types of completion.

Text Books:

1. Advanced Well Completions, Renpu Way , 3rd Edition Gulf Publishing , 2011.
2. Well Completion Design by Jonathan Bellarby, Elsevier, 2009.
3. Subsea Drilling Well Operations and Completions, working document of the NPC North American Resource Development Study, 2011.
4. Offshore well completions and simulation: using hydraulic fracturing and other technologies.

Reference Books:

1. Petroleum Engineering: Principles and Practice, J.S Archer & C.G.Wall, Graham& Trontman, Inc.,1986.
2. Primer of Well Service Workover and Completion, Petroleum Extension Service (PETEX), University of Texas at Austin, 1997.

Web Links:

1. http://www.scmdaleel.com/category/completion-equipment/107
2. https://petrowiki.org/PEH:Tubing_Selection_Design_and_installation

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ADVANCED WELL LOGGING AND WELL TESTING ANALYSIS

(Professional Elective-II)

I Semester | **L T P C**
Course Code: 192PE1E04 | **3 0 0 3**

Course Objectives:

- COB 1: To help students learn Physical properties of the subsurface, strata like resistivity, porosity, thickness etc.
- COB 2: To impart knowledge on Log Interpretation data with the help of advanced technology tools.
- COB 3: To familiarize with Analysis of flow and pressure tests in oil reservoirs, fractured wells.
- COB 4: To help students apply Flow modelling in reservoir with respective to fracture porosity
- COB 5: To impart knowledge on Pressure derivates and multi rate tests of reservoir flows.

Course Outcomes:

At the end of the course, the student will be able to:

- CO 1: Apply theoretical knowledge of well logging
- CO 2: Interpret the Data from well logging using advanced tools
- CO 3: Calculate reservoir fracture porosity using pressure build-up tests
- CO 4: Interpret Dip meter logs to obtain structural dips and correlation of the same with the nearby offset wells.
- CO 5: Apply Multi rate analysis in Naturally fractured reservoirs.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO 1 (K5)	PO 2 (K4)	PO 3 (K5)	PO 4 (K3)	PO 5 (K3)	PO 6 (K4)	PO 7 (K6)	PO 8 (K2)	PO 9 (K2)	PO 10 (K2)	PO11 (K4)
CO1 (K2)	2	1	2	-	-	-	-	-	-	-	-
CO2 (K2)	-	-	3	-	-	-	-	-	-	-	-
CO3 (K3)	2	3	2	-	-	-	-	-	-	-	-
CO4 (K2)	2	-	-	3	2	-	-	-	-	-	-
CO5 (K3)	-	-	2	-	2	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1 (K3)	PSO 2 (K2)	PSO 3 (K4)	PSO4(K3)
CO1 (K2)	2	-	-	-
CO2 (K2)	2	-	-	1
CO3 (K3)	2	1	-	-
CO4 (K2)	-	1	1	1
CO5 (K3)	1	2	1	-

UNIT-I:

Latest advances in Micro and Spherically focused logs to image thin beds and different radioactive logs and their utility in calculating density, porosity and estimation of water saturation.

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UNIT-II:

NMR logging and their recent advances in the industry. Understanding of fluid saturation from NMR logs. Identification of fractures through formation Micro imager.

UNIT-III:

Cement bond log- Casing collar log-Depth control- Perforation technique-Casing inspection logs. Production logging: Solving production problems with the help of Fluid Density log-Temperature log and Flow meter logs

UNIT-IV:

Application of Pressure and Derivative to Drawdown and Build up Tests:

Pressure-based analysis of flow and build up tests- Derivative-based analysis of flow and build up tests, TDS technique-Determining Average reservoir pressure-Drainage area and pore volume of bounded systems, oil in place.

Hydraulically Fractured Wells and Gas Well Testing: Uniform-flux and infinite-conductivity models of hydraulic fractures- Finite-conductivity: linear, bilinear, and elliptical flow-Geometry of inclined hydraulic fractures-Interpreting gas well tests using pressure and pseudo-pressure derivative.

UNIT-V:

Naturally Fractured Reservoirs and Carbonates:

Indicators and types of NFR-Pseudo-steady state and unsteady state matrix flow models- Storativity and Porosity Partitioning coefficient-Fracture porosity from well logs and well test analysis Interpretation of interference and pulse tests, pressure derivative.

Multiphase Flow, Multirate Tests, and Partially Perforated Wells: Conventional and modern interpretation of multi-rate tests- Applications of TDS, convolution and deconvolution techniques- Partially completed/penetrated/perforated wells-Vertical permeability from spherical flow, MDT.

Text Books:

1. Open-Hole Log Analysis and Formation Evaluation, Richard M. Batemons, International Human Resources Development Corporation, Bostan, 1985.
2. Well Logging for Earth Scientists, Darwin V. Ellis, Julian M. Singer, Springer, 2007.
3. Petroleum Reservoir Engineering Practice, Nnaemeka Ezekwe, 1st Edition, Prentice Hall, 2010.
4. Advanced Reservoir Engineering, Tarek Ahmed and Paul D Mc Kinney, Gulf Professional publishing, Elsevier, 2005.

Reference Books:

1. Fundamentals of Well Log Interpretation: The Acquisition of Data, Oberto Serra, Elsevier, 1984.
2. Well Logging Handbook, Oberto Serra, Editions Technip, 2008.

Web Links:

1. http://www.scielo.br
2. https://www.studentenergy.org
3. https://en.wikipedia.org/wiki/Pipeline_transport

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Department of Petroleum Technology

1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Advanced well logging techniques and well testing analysis	Advanced well logging techniques and well testing analysis
Course Code	192PE1E04	192PE1E04
Syllabus	UNIT-III: Cement bond log- Casing collar log-Depth control- Perforation technique-Casing inspection logs. Production logging: Solving production problems with the help of Fluid Density log-Temperature log and Flow meter logs	UNIT-III: Principles and operation of Dip-meter logs. Interpretation of Dip meter logs to obtain structural dips of the layers encountered in the borehole and correlation of the same with the nearby offset wells

Signature of the course coordinator

Signature of the HOD

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ADITYA ENGINEERING COLLEGE
An Autonomous Institution
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Recognised by UGC under sections 2(f) and 12(B) of UGC Act, 1956
Aditya Nagar, ADB Road, Surampalem - 533437, Near Kakinada, E.G.Dt., Ph:99498 76662

Department of Petroleum Technology

1.1.2. Table-Prior/Post revision of syllabus

Regulation	Pre-Revision	Post-Revision
Course Title	Advanced well completions	Advanced well completions
Course Code	192PE2E06	192PE2E06
Syllabus	UNIT-V: Well completion: Types of wells-Completion functions- Types of completion	UNIT-V: Installation of Completion Systems: Wellbore Clean-out and mud displacement, Completion fluids and filtration, Well clean-up and flow initiation.

Signature of the course coordinator

Signature of the HOD

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Program Name : INTEGRATED MASTER OF BUSINESS ADMINISTRATION

Syllabus Revision for the Academic Year 2021-22				
S.No	**Semester**	**Course Code**	**Course Name**	**% of content revised for the existing year**
1	I	195IM1T01	English Language – I	0
2	I	195IM1T02	Business Mathematics & Statistics	0
3	I	195IM1T03	Fundamentals of Business Organization	0
4	I	195IM1T04	Financial Accounting – I	0
5	I	195IM1T05	Fundamentals of Computers	0
6	II	195IM2T06	English Language – II	0
7	II	195IM2T07	Business Environment	0
8	II	195IM2T08	Managerial Economics	0
9	II	195IM2T09	Financial Accounting – II	0
10	II	195IM2T10	Organizational Communications	0
11	III	195IM3T11	Principles of Management	0
12	III	195IM3T12	Cost Accounting	0
13	III	195IM3T13	Banking Theory & Practice	0
14	III	195IM3T14	Business Law	0
15	III	195IM3T15	Entrepreneurship Development	0
16	IV	195IM4T16	Organizational Behavior	0
17	IV	195IM4T17	Management Accounting	0
18	IV	195IM4T18	Company Law	0
19	IV	195IM4T19	Elements of Direct & Indirect Taxes	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
20	IV	195IM4T20	Management Information Systems	0
21	V	195IM5T21	Financial Management	0
22	V	195IM5T22	Marketing Management	0
23	V	195IM5T23	Human Resource Management	0
24	V	195IM5T24	Operations Management	0
25	V	195IM5T25	Business Research Methodology	0
26	VI	195IM6T26	Operations Research	0
27	VI	195IM6T27	International Business	0
28	VI	195IM6T28	Strategic Management	0
29	VI	195IM6T29	Decision Support Systems	0
30	VI	195IM1P01	Summer Internship (6 Weeks)	0
31	VII	175IM7T30	Knowledge Management	0
32	VII	175IM7T31	Strategic Cost Management	0
33	VII	175HR7E01	Human Resource Planning	0
34	VII	175HR7E02	Leadership Management	0
35	VII	175HR7E03	Compensation and Reward Management	0
36	VII	175FI7E01	Security Analysis	0
37	VII	175FI7E02	Banking and Insurance Management	0
38	VII	175FI7E03	Advanced Management Accounting	0
39	VII	175MA7E03	Supply Chain Management	0
40	VII	175SY7E01	E-Business	0
41	VII	175SY7E02	Relational Database Management Systems	0
42	VII	175SY7E03	Web Designing	0
43	VII	175MA7E01	Consumer Behavior	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
44	VII	175MA7E02	Rural Marketing	0
45	VIII	175HR8E05	Strategic Human Resource Management	0
46	VIII	175HR8E06	Organizational Development & Change	0
47	VIII	175IM8T32	Total Quality Management	0
48	VIII	175IM8T33	Project Management	0
49	VIII	175FI8E04	Strategic Financial Management	0
50	VIII	175FI8E05	Portfolio Management	0
51	VIII	175SY8E04	System Analysis & Design	0
52	VIII	175SY8E05	Business Intelligence	0
53	VIII	175SY8E06	Enterprise Resource Planning	0
54	VIII	175FI8E06	Financial Markets and Services	0
55	VIII	175MA8E04	Customer Relationship Management	0
56	VIII	175MA8E05	Strategic Marketing Management	0
57	VIII	175MA8E06	Services Marketing	0
58	VIII	175HR8E04	Performance Management	0
59	IX	175HR9E07	Global Human Resource Management	0
60	IX	175IM9T34	Intellectual Property Rights	0
61	IX	175IM9T35	Corporate Governance	0
62	IX	175HR9E08	Labor Welfare & Legislation	0
63		175HR9E09	Management of	0
64	IX		Industrial Relations	0
65	IX	175FI9E07	Global Financial Management	0
66	IX	175FI9E08	Risk Management	0
67	IX	175FI9E09	Tax Management	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
68	IX	175MA9E07	Promotion and Distribution Management	0
69	IX	175MA9E08	Global Marketing Management	0
70	IX	175MA9E09	Retail Marketing	0
71	IX	175SY9E07	Cyber Laws & Security	20
72	IX	175SY9E08	Information Systems & Audit	20
73	IX	175SY9E09	SAP	20
74	X	175IMAP02	Major Project	0

Total number of courses in the academic year 2021-22	= 73
Number of courses having revision in syllabus content >/= 20% in the academic year 2021-22	= 03
Percentage of syllabus revision carried out in the academic year 2021-22 = (3/73)*100	'= 4.10%

K. Shailaja
Program Coordinator

N. Vinod
Head of the Department

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PROGRAM STRUCTURE

I SEMESTER

Course Code	Name of the Course	Lecture (L)	Credits (C)
175IM1T01	English Language – I	4	4
175IM1T02	Business Mathematics & Statistics	4	4
175IM1T03	Fundamentals of Business Organization	4	4
175IM1T04	Financial Accounting – I	4	4
175IM1T05	Fundamentals of Computers	4	4
	TOTAL	**20**	**20**

II SEMESTER

Course Code	Name of the Course	Lecture (L)	Credits (C)
175IM2T06	English Language – II	4	4
175IM2T07	Business Environment	4	4
175IM2T08	Managerial Economics	4	4
175IM2T09	Financial Accounting – II	4	4
175IM2T10	Organizational Communications	4	4
	TOTAL	**20**	**20**

III SEMESTER

Course Code	Name of the Course	Lecture (L)	Credits (C)
175IM3T11	Principles of Management	4	4
175IM3T12	Cost Accounting	4	4
175IM3T13	Banking Theory & Practice	4	4
175IM3T14	Business Law	4	4
175IM3T15	Entrepreneurship Development	4	4
	TOTAL	**20**	**20**

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IV SEMESTER

Course Code	Name of the Course	Lecture (L)	Credits (C)
175IM4T16	Organizational Behavior	4	4
175IM4T17	Management Accounting	4	4
175IM4T18	Company Law	4	4
175IM4T19	Elements of Direct & Indirect Taxes	4	4
175IM4T20	Management Information Systems	4	4
	TOTAL	**20**	**20**

V SEMESTER

Course Code	Name of the Course	Lecture (L)	Credits (C)
175IM5T21	Financial Management	4	4
175IM5T22	Marketing Management	4	4
175IM5T23	Human Resource Management	4	4
175IM5T24	Production & Operations Management	4	4
175IM5T25	Research Methodology	4	4
	TOTAL	**20**	**20**

VI SEMESTER

Course Code	Name of the Course	Lecture (L)	Credits (C)
175IM6T26	Operations Research	4	4
175IM6T27	International Business	4	4
175IM6T28	Strategic Management	4	4
175IM6T29	Decision Support Systems	4	4
175IM6P01	Minor Project	---	4
	TOTAL	**16**	**20**

Note: The Student has to choose the Electives from the four Specializations available (HR, Finance, Marketing, Systems)

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VII SEMESTER

Course Code	Name of the Course	Lecture (L)	Credits (C)
175IM7T30	Knowledge Management	4	4
175IM7T31	Strategic Cost Management	4	4
---	Elective - I	4	4
---	Elective - II	4	4
---	Elective - III	4	4
	TOTAL	20	20

VIII SEMESTER

Course Code	Name of the Course	Lecture (L)	Credits (C)
175IM8T32	Total Quality Management	4	4
175IM8T33	Project Management	4	4
---	Elective - IV	4	4
---	Elective - V	4	4
---	Elective - VI	4	4
	TOTAL	20	20

IX SEMESTER

Course Code	Name of the Course	Lecture (L)	Credits (C)
175IM9T34	Intellectual Property Rights	4	4
175IM9T35	Corporate Governance	4	4
---	Elective - VII	4	4
---	Elective - VIII	4	4
---	Elective - IX	4	4
	TOTAL	20	20

X SEMESTER

Course Code	Name of the Course	Lecture (L)	Credits (C)
175IMAP02	Major Project	---	18
	TOTAL	---	18

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Elective	HR	FINANCE	MARKETING	SYSTEMS
Elective – I	Human Resource Planning (175HR7E01)	Security Analysis (175FI7E01)	Consumer Behavior (175MA7E01)	E-Business (175SY7E01)
Elective – II	Leadership Management (175HR7E02)	Banking and Insurance Management (175FI7E02)	Rural Marketing (175MA7E02)	Relational Database Management Systems (175SY7E02)
Elective – III	Compensation and Reward Management (175HR7E03)	Advanced Management Accounting (175FI7E03)	Supply Chain Management (175MA7E03)	Web Designing (175SY7E03)
Elective – IV	Performance Management (175HR8E04)	Strategic Financial Management (175FI8E04)	Customer Relationship Management (175MA8E04)	System Analysis & Design (175SY8E04)
Elective – V	Strategic Human Resource Management (175HR8E05)	Portfolio Management (175FI8E05)	Strategic Marketing Management (175MA8E05)	Business Intelligence (175SY8E05)
Elective – VI	Organizational Development & Change Management (175HR8E06)	Financial Markets and Services (175FI8E06)	Services Marketing (175MA8E06)	Enterprise Resource Planning (175SY8E06)
Elective – VII	Global Human Resource Management (175HR9E07)	Global Financial Management (175FI9E07)	Promotion and Distribution Management (175MA9E07)	Cyber Laws & Security (175SY9E07)
Elective – VIII	Labor Welfare & Legislation (175HR9E08)	Risk Management (175FI9E08)	Global Marketing Management (175MA9E08)	Information Systems & Audit (175SY9E08)
Elective – IX	Management of Industrial Relations (175HR9E09)	Tax Management (175FI9E09)	Retail Marketing (175MA9E09)	SAP (175SY9E09)

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INFORMATION SYSTEMS & AUDIT
(ELECTIVE VIII-SYSTEMS)

IX Semester L C
Course Code: 175SY9E08 4 4

Course Objectives:

- COB 1: To help in understanding basic concepts in Information Systems Audit.
- COB 2: To help in understanding the importance of Information and systems audit.
- COB 3: To help in analyzing the effects of Information Systems and Audit.

Course Outcomes:
At the end of this course students will be able to:

- CO 1: Describe the meaning and concepts of Information System Auditing.
- CO 2: Explain the importance of Management Control Framework.
- CO 3: Distinguish Management Control Framework required for establishing effective controls.
- CO 4: Compare and contrast Evidence Evaluation systems.
- CO 5: Research corporate governance issues in Indian context.

Mapping of program outcome and course outcome

CO/PO	PO 1 (K3)	PO 2 (K5)	PO 3 (K1)	PO 4 (K4)	PO 5 (K5)	PO 6 (K4)	PO 7 (K3)	PO 8 (K3)	PO 9 (K3)	PO 10 (K3)	PO11 (K5)
CO1 (K2)	2	-	3	-	-		2	-	-	2	-
CO2 (K2)	2	-	3	-	-		2	-	-	2	-
CO3 (K4)	3	2	3	-	2		3	-	-	3	2
CO4 (K4)	3	2	3	-	2		3	-	-	3	2
CO5 (K2)	2	-	3	-	-		2	-	-	2	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1 (K3)	PSO 2 (K4)	PSO 3 (K4)
CO1 (K2)	2	-	1
CO2 (K2)	2	-	1
CO3 (K4)	3	-	3
CO4 (K4)	3	-	3
CO5 (K2)	2	-	1

UNIT-I:
Overview of Information System Auditing: Effect of Computers on Internal Controls, Effects of Computers on Auditing, Foundations of information Systems Auditing, Conducting an Information Systems Audit.

UNIT-II:
The Management Control Framework-I: Introduction, Evaluation the Planning Function, Leading Function and Controlling Function, Systems Development - Management Controls, Approaches to Auditing Systems Development , Normative Models of the Systems Development Process, Evaluating the Major phases in the Systems Development Process, Programming Management Controls, Data Resource Management Controls.

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UNIT-III:

The Management Control Framework-II: Security Management Controls, Operations Management Controls Quality Assurance Management Controls- Case Studies.

UNIT-IV:

Evidence Collection: Audit Software, Code Review, Test Data, and Code Comparison, Concurrent Auditing techniques, Interviews, Questionnaires, and Control Flowcharts. Performance Management tools- Case Studies.

UNIT-V:

Evidence Evaluation: Evaluating Asset Safeguarding and Data Integrity, Evaluating System Effectiveness, Evaluating System Efficiency. Information Systems Audit and Management: Managing the Information Systems Audit Function,

Relevant cases have to be discussed in each unit and in examination case is compulsory from any unit.

Reference Books:

1. Ron Weber: "Information Systems Control and Audit", Pearson Education, 2013.
2. D P Dube: Information System Audit and Assurance, TMH, New Delhi, 2008.

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SAP
(SYSTEM APPLICATIONS AND PRODUCTS IN DATA PROCESSING)
(ELECTIVE IX-SYSTEMS)

IX Semester	**L**	**C**
Course Code: 175SY9E09	**4**	**4**

Course Objectives:

COB 1: Be familiar with basic Concepts of SAP and Object-Oriented Programming.
COB 2: To acquire general knowledge on SAP Objective Settings process, Appraisals template Creation and its integrations with other components.
COB 3: To understand the mechanism of SAP and its Functional Modules.

Course Outcomes:
At the end of this course students will be able to:

CO 1: Understand the Date Wearhouse and apply the architecture of Data Warehouses.
CO 2: Understand and Apply the Object-Oriented programming and BPM implementation of plans and strategies to the organization.
CO 3: Apply the concepts of Organizational Management and Commodity Management.
CO 4: Understand and Apply the SAP Master Data.
CO 5: Understand and Apply the SAP functional Modules-FI/CO, HRM, SD.

Mapping of program outcome and course outcome

CO/PO	PO 1 (K3)	PO 2 (K5)	PO 3 (K1)	PO 4 (K4)	PO 5 (K5)	PO 6 (K4)	PO 7 (K3)	PO 8 (K3)	PO 9 (K3)	PO 10 (K3)	PO11 (K5)
CO1 (K2)	2	-	-	-	-	-	-	-	-	-	-
CO2 (K2)	3	-	-	-	-	-	-	-	-	-	-
CO3 (K4)	3	-	-	-	-	-	-	-	-	-	-
CO4 (K4)	3	2	-	-	-	-	-	-	-	-	-
CO5 (K2)	3	-	-	2	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1 (K3)	PSO 2 (K4)	PSO 3 (K4)
CO1 (K2)	3	-	-
CO2 (K2)	3	-	-
CO3 (K4)	3	-	-
CO4 (K4)	3	-	-
CO5 (K2)	3	-	-

UNIT-I:
Introduction to data warehouses: Introduction to Data Warehouse, OLTP Systems; Differences between OLTP Systems and Data Warehouse: Characteristics, Functions, Applications and types of Data Warehouse.
SAP Portfolio Overview: Identify the parts of the SAP Portfolio, Listing the key capabilities of SAP Net weaver, considering the Release strategy of SAP

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UNIT-II:
Introduction to Object –Oriented Programming: Object-Oriented Programming Model, Analyzing and Design Unified Modeling Language (UML), Class, Objects, Constructors.
Business Processes Management: Definition, Process of BPM, Process Models, BPM Life Cycle, Process Identification, Core Processes, Support Processes.

UNIT-III:
Organizational Management Concepts: **Organizational Management Concepts, Objects Relationships, planning objects, confirm the active plan version, object characteristics**.
Commodity Management: SAP Commodity Procurement, SAP Commodity Sales, SAP Commodity Risk Management.

UNIT-IV:
SAP Master Data: Master Data Introduction-Explore SAP ERP Basics Master Data, MDG Overview, Roadmap and Product Portfolio-Explore MDG Introduction Central Governance and Mass Processing-Describe the general concepts and capabilities of SAP MDG, central governance-Illustrate the scope of SAP MDG, central governance in the current version-Understand EIM Product Portfolio.

UNIT-V:
SAP Modules: FI/CO-Automatic Payments- Dunning Program- Correspondence- Basics of Parallel Accounting- Document Control- Posting Control- Clearing, **HRM-**Organization management –time management –payroll-ESS& MSS, **SD**-Enterprise Structures in sales and Distribution –Overview of sales Process-master data in sales and distribution.
Relevant cases have to be discussed in each unit and in examination case is compulsory from any unit.

Reference Books:

1. Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining and OLAP", Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
2. SAP S/4 HANA. An Introduction written by Devraj Bardhan, Axel Baumartl, Nga-Sze Choi, Mark Dudgeon, Asidhara Lahiri, Bert Meijerink, Andrew Worsley-Tonks.
3. Commodity Derivatives and Risk Management by Prabina.

D. Veeral

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CYBER LAWS & SECURITY
(ELECTIVE VII-SYSTEMS)

IX Semester — **L** 4 — **C** 4

Course Code: 175SY9E07

Course Objectives:

- COB 1: To help in understanding basic concepts in cyber security.
- COB 2: To help in understanding the importance of Secure System Planning and administration
- COB 3: To help in analysing the effects of Secure System Planning and administration.

Course Outcomes:
At the end of this course students will be able to:

- CO 1: Describe the meaning and concepts of cyber security.
- CO 2: Explain the importance of Secure System Planning and administration.
- CO 3: Distinguish Information security policies and procedures in organizations.
- CO 4: Compare and contrast the practical applications of Information security systems.
- CO 5: Research on Organizational and Human Security.

Mapping of program outcome and course outcome

CO/PO	PO 1 (K3)	PO 2 (K5)	PO 3 (K1)	PO 4 (K4)	PO 5 (K5)	PO 6 (K4)	PO 7 (K3)	PO 8 (K3)	PO 9 (K3)	PO 10 (K3)	PO11 (K5)
CO1 (K2)	2	-	-	-	-	1	-	2	2	2	-
CO2 (K2)	2	-	-	-	-	1	-	2	2	2	-
CO3 (K4)	3	-	-	-	2	3	-	3	3	3	2
CO4 (K4)	3	-	-	-	2	3	-	3	3	3	2
CO5 (K2)	2	-	-	-	-	1	-	2	2	2	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1 (K3)	PSO 2 (K4)	PSO 3 (K4)
CO1 (K2)	2	1	-
CO2 (K2)	2	1	-
CO3 (K4)	3	3	-
CO4 (K4)	3	3	-
CO5 (K2)	2	1	-

UNIT-I:
Introduction to Computer Security: Definition, Threats to security, Government requirements, Information Protection and Access Controls, Computer security efforts, Standards, Computer Security mandates and legislation, Privacy considerations, International security activity.

UNIT-II:
Secure System Planning and administration: Introduction to the orange book, Security policy requirements, accountability, assurance and documentation requirements, Network Security, The Red book and Government network evaluations.

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UNIT-III:
Information security policies and procedures: Corporate policies- Tier 1, Tier 2 and Tier3 policies - process management-planning and preparation-developing policies-asset classification policy-developing standards.

UNIT-IV:
Information security: fundamentals-Employee responsibilities- information classification Information handling- Tools of information security- Information processing-secure program administration.

UNIT-V:
Organizational and Human Security: Adoption of Information Security Management Standards, Human Factors in Security- Role of information security professionals.

Relevant cases have to be discussed in each unit and in examination case is compulsory from any unit.

Reference Books:

1. Debby Russell and Sr. G.T Gangemi, "Computer Security Basics (Paperback)", 2nd Edition, O' Reilly Media, 2006.
2. Thomas R. Peltier, "Information Security policies and procedures: A Practitioner's Reference", 2nd Edition Prentice Hall, 2004.
3. Kenneth J. Knapp, "Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions", IGI Global, 2009.
4. Thomas R Peltier, Justin Peltier and John blackley, "Information Security Fundamentals", 2nd Edition, Prentice Hall, 1996.
5. Jonathan Rosenoer, "Cyber law: the Law of the Internet", Springer-verlag, 1997.

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Syllabus revision Index (2021-22)

S.No	Name of the course	Percentage of syllabus change
1.	Cyber Laws & Security	**20**
2.	Information Systems & Audit	**20**
3.	SAP	**20**

N. Vinod

Signature of the HOD

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Department of Management Studies

1.1.2. Table-Prior/Post revision of syllabus (2021-22)

Regulation	Pre-Revision	Post-Revision
Course Title	Cyber Laws & Security	Cyber Laws & Security
Course Code	16IM903	174SY4E03
Syllabus	UNIT-1: Introduction to Computer Security: Definition, Threats to security, Government requirements, Information Protection and Access Controls, Computer security efforts, Standards, Computer Security mandates and legislation, Privacy considerations, International security activity.	UNIT-1: Introduction to Computer Security: Definition, Threats to security, Government requirements, Information Protection and Access Controls, Computer security efforts, Standards, Computer Security mandates and legislation, Privacy considerations, International security activity.
	UNIT-2: Secure System Planning and administration: Introduction to the orange book, Security policy requirements, accountability, assurance and documentation requirements, Network Security, The Red book and Government network evaluations	UNIT-2: Secure System Planning and administration: Introduction to the orange book, Security policy requirements, accountability, assurance and documentation requirements, Network Security, The Red book and Government network evaluations
	UNIT-3: Information security policies and procedures: Corporate policies-Tier 1, Tier 2 and Tier3 policies - process management-planning and preparationdeveloping policies-asset classification policy-developing standards	UNIT-3: Information security policies and procedures: Corporate policies- Tier 1, Tier 2 and Tier3 policies - process management-planning and preparationdeveloping policies-asset classification policy-developing standards
	. UNIT-4: Information security: fundamentals-Employee responsibilities- information classification Information handling-Tools of information security-Information processing-secure program administration.	. UNIT-4: Information security: fundamentals-Employee responsibilities- information classification Information handling-Tools of information security-Information processing-secure program administration.

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	UNIT-5: Organizational and Human Security: Adoption of Information Security Management Standards, Human Factors in Security- Role of information security professionals. Relevant cases have to be discussed in each unit and in examination case is compulsory from any unit	UNIT-5: E – commerce and Laws in India (a) Digital ,Electronic Signature in Indian Laws E – Commerce; Issues and provisions in Indian Law E – Governance; concept and practicality in India E – Taxation issues in Cyberspace E – Contracts and its validity in India Cyber Tribunal & Appellate Tribunal (g) Cyber Regulations

D. Mehari

Signature of the course coordinator

N. Usal

Signature of the HOD

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Department of Management Studies

1.1.2. Table-Prior/Post revision of syllabus (2021-22)

Regulation	Pre-Revision	Post-Revision
Course Title	Information Systems & Audit	Information Systems & Audit
Course Code	16IM904	174SY4E04
Syllabus	Overview of Information System Auditing: Effect of Computers on Internal Controls, Effects of Computers on Auditing, Foundations of information Systems Auditing, Conducting an Information Systems Audit..	UNIT-1: Overview of Information System Auditing: Effect of Computers on Internal Controls, Effects of Computers on Auditing, Foundations of information Systems Auditing, Conducting an Information Systems Audit
	. UNIT-2: The Management Control UNIT-II: The Management Control Framework-I: Introduction, Evaluation the Planning Function, Leading Function and Controlling Function, Systems Development - Management Controls, Approaches to Auditing Systems Development , Normative Models of the Systems Development Process, Evaluating the Major phases in the Systems Development Process, Programming Management Controls, Data Resource Management Controls	. UNIT-2: The Management Control Framework-I: Introduction, Evaluation the Planning Function, Leading Function and Controlling Function, Systems Development - Management Controls, Approaches to Auditing Systems Development , Normative Models of the Systems Development Process, Evaluating the Major phases in the Systems Development Process, Programming Management Controls, Data Resource Management Controls.
	UNIT-III: The Management Control Framework-II: Security Management Controls, Operations Management Controls Quality Assurance Management Controls- Case Studies. UNIT-V: Evidence Evaluation: Evaluating Asset Safeguarding and Data Integrity, Evaluating System Effectiveness, Evaluating System Efficiency. Information Systems Audit and Management: Managing the Information Systems Audit Function	Database Management – Data Base Concepts – Data Structure – Data Base Management System – Data Base Files – Data Mining and Warehousing

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	UNIT-IV: Evidence Collection: Audit Software, Code Review, Test Data, and Code Comparison, Concurrent Auditing techniques, Interviews, Questionnaires, and Control Flowcharts. Performance Management tools- Case Studies.	UNIT-4: Evidence Collection: Audit Software, Code Review, Test Data, and Code Comparison, Concurrent Auditing techniques, Interviews, Questionnaires, and Control Flowcharts. Performance Management tools- Case Studies.
	. UNIT-5: Evidence Evaluation: Evaluating Asset Safeguarding and Data Integrity, Evaluating System Effectiveness, Evaluating System Efficiency. Information Systems Audit and Management: Managing the Information Systems Audit Function,	. UNIT-5: Evidence Evaluation: Evaluating Asset Safeguarding and Data Integrity, Evaluating System Effectiveness, Evaluating System Efficiency. Information Systems Audit and Management: Managing the Information Systems Audit Function,

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Signature of the course coordinator

N. Viral

Signature of the HOD

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1.1.2. Table-Prior/Post revision of syllabus (2021-22)

Regulation	Pre-Revision	Post-Revision
Course Title	SAP	SAP
Course Code	16IM905	175SY9E09
Syllabus	Introduction to data warehouses: Introduction to Data Warehouse, OLTP Systems; Differences between OLTP Systems and Data Warehouse: Characteristics, Functions, Applications and types of Data Warehouse. SAP Portfolio Overview: Identify the parts of the SAP Portfolio, Listing the key capabilities of SAP Net weaver, considering the Release strategy of SAP	Introduction to data warehouses: Introduction to Data Warehouse, OLTP Systems; Differences between OLTP Systems and Data Warehouse: Characteristics, Functions, Applications and types of Data Warehouse. SAP Portfolio Overview: Identify the parts of the SAP Portfolio, Listing the key capabilities of SAP Net weaver, considering the Release strategy of SAP
	UNIT-II: Introduction to Object – Oriented Programming: Object-Oriented Programming Model, Analyzing and Design Unified Modeling Language (UML), Class, Objects, Constructors. Business Processes Management: Definition, Process of BPM, Process Models, BPM Life Cycle, Process Identification, Core Processes, Support Processes.	UNIT-II: Business processes and scenarios: Definition, Why BPM, what is a business process, various Process Models, BPM Life Cycle, Process Identification, core processes, support processes
	UNIT-III: Organizational Management Concepts: Organizational Management Concepts, Objects Relationships, planning objects, confirm the active plan version, object characteristics. Commodity Management: SAP Commodity Procurement, SAP Commodity Sales, SAP Commodity Risk Management.	UNIT-III: Organizational Management Concepts: Organizational Management Concepts, Objects Relationships, planning objects, confirm the active plan version, object characteristics. Commodity Management: SAP Commodity Procurement, SAP Commodity Sales, SAP Commodity Risk Management.
	UNIT-IV: SAP Master Data: Master Data Introduction-Explore SAP ERP	UNIT-IV: SAP Master Data: Master Data Introduction-Explore SAP ERP

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	Basics Master Data, MDG Overview, Roadmap and Product Portfolio-Explore MDG Introduction Central Governance and Mass Processing-Describe the general concepts and capabilities of SAP MDG, central governance-Illustrate the scope of SAP MDG, central governance in the current versionUnderstand EIM Product Portfolio.	Basics Master Data, MDG Overview, Roadmap and Product Portfolio-Explore MDG Introduction Central Governance and Mass Processing-Describe the general concepts and capabilities of SAP MDG, central governance-Illustrate the scope of SAP MDG, central governance in the current versionUnderstand EIM Product Portfolio.
	UNIT-V: SAP Modules: FI/CO-Automatic Payments- Dunning Program- Correspondence- Basics of Parallel Accounting- Document Control- Posting Control- Clearing, HRM-Organization management – time management –payroll-ESS& MSS, SD-Enterprise Structures in sales and Distribution –Overview of sales Process-master data in sales and distribution. Relevant cases have to be discussed in each unit and in examination case is co	UNIT-V: SAP Modules: FI/CO-Automatic Payments- Dunning Program- Correspondence- Basics of Parallel Accounting- Document Control- Posting Control- Clearing, HRM-Organization management –time management –payroll-ESS& MSS, SD-Enterprise Structures in sales and Distribution –Overview of sales Process-master data in sales and distribution. Relevant cases have to be discussed in each unit and in examination case is co

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Program Name : MASTER OF BUSINESS ADMINISTRATION

Syllabus Revision for the Academic Year 2021-22				
S.No	Semester	Course Code	Course Name	% of content revised for the existing year
1	I	194MB1T01	Management and Organizational Behavior	0
2	I	194MB1T02	Managerial Economics	0
3	I	194MB1T03	Accounting for Managers	0
4	I	194MB1T04	Quantitative Analysis for Business Decisions	0
5	I	194MB1T05	Legal and Business Environment	0
6	I	194MB1T06	Business Communication and Soft Skills	0
7	I	194MB1L01	Business Communication and Soft Skills Lab.	0
8	I	194MB1L02	Information Technology – Lab – I (Spreadsheet and Tally)	0
9	II	194MB2T07	Financial Management	0
10	II	194MB2T08	Human Resource Management	0
11	II	194MB2T09	Marketing Management	0
12	II	194MB2T10	Operations Management	0
13	II	194MB2T11	Business Research Methods	0
14	II	194MB2O04	Project Management.	0
15	II	194MB2L03	IT-Lab – 2 (R Programming)	0
16	I	194MB1O01	Cross Cultural Management.	0

S.No	Semester	Course Code	Course Name	% of content revised for the existing year
38	IV	194MB4T15	Innovation and Entrepreneurship	0
39	IV	194HR4E05	Labour Welfare and employment laws	0
40	IV	194HR4E06	International HRM	0
41	IV	194HR4E07	Employee Relations and Engagement	0
42	IV	194HR4E08	Strategic HRM	0
43	IV	194FI4E05	Financial Derivatives	0
44	IV	194FI4E06	International HRM	0
45	IV	194FI4E07	Risk Management	0
46	IV	194FI4E08	Behavioral Finance	0
47	IV	194MA4E05	Services Marketing	0
48	IV	194MA4E06	Promotional and Distribution Management	0
49	IV	194MA4E07	Green Marketing	0
50	IV	194MA4E08	Global Marketing Management	0
51	IV	194MB4C01	Comprehensive Viva - Voce	0
52	III	194SY3E01	Data Mining for Business Decisions	0
53	III	194SY3E02	Managing Software Projects	0
54	III	194SY3E03	Web Designing	0
55	III	194SY3E04	Business Analytics	0
56	IV	194SY4E05	Big Data Analytics	0
57	IV	194SY4E06	Enterprise Resource Planning	0
58	IV	194SY4E07	Cyber Laws & Security	0

2021-22

PROGRAM STRUCTURE

I SEMESTER

Course Code	Name of the Course	Lecture (L)	Tutorial (T)	Practice (P)	Credits (C)
194MB1T01	Management and Organizational Behavior	4	0	0	4
194MB1T02	Managerial Economics	4	0	0	4
194MB1T03	Accounting for Managers	4	0	0	4
194MB1T04	Quantitative Analysis for Business Decisions	4	0	0	4
194MB1T05	Legal and Business Environment	4	0	0	4
194MB1T06	Business Communication and Soft Skills	4	0	0	4
---	Open Elective-I	4	0	0	4
194MB1L01	Business Communication and Soft Skills Lab.	0	0	2	2
194MB1L02	Information Technology – Lab – I (Spreadsheet and Tally)	0	0	2	2
	TOTAL	**28**	**0**	**2**	**32**

II SEMESTER

Course Code	Name of the Course	Lecture (L)	Tutorial (T)	Practice (P)	Credits (C)
194MB2T07	Financial Management	4	0	0	4
194MB2T08	Human Resource Management	4	0	0	4
194MB2T09	Marketing Management	4	0	0	4
194MB2T10	Operations Management	4	0	0	4
194MB2T11	Business Research Methods	4	0	0	4
---	Open Elective-II	4	0	0	4
194MB2L03	IT-Lab – 2 (R Programming)	0	0	2	2
	TOTAL	**24**	**0**	**2**	**26**

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III SEMESTER

Course Code	Name of the Course	Lecture (L)	Tutorial (T)	Practice (P)	Credits (C)
194MB3T12	Strategic Management	4	0	0	4
194MB3T13	Operations Research	4	0	0	4
---	Elective - I	4	0	0	3
---	Elective - II	4	0	0	3
---	Elective - III	4	0	0	3
---	Elective – IV	4	0	0	3
194MB3P01	Industrial Project based on Summer Internship	4	0	0	4
	TOTAL	**28**	**0**	**2**	**24**

IV SEMESTER

Course Code	Name of the Course	Lecture (L)	Tutorial (T)	Practice (P)	Credits (C)
194MB4T14	Supply Chain Management and Analytics	4	0	0	4
194MB4T15	Innovation and Entrepreneurship	4	0	0	4
---	Elective – V	4	0	0	3
---	Elective - VI	4	0	0	3
---	Elective - VII	4	0	0	3
---	Elective - VIII	4	0	0	3
194MB4C01	Comprehensive Viva - Voce	2	0	0	2
	TOTAL	**26**	**0**	**2**	**22**

Note: The Student has to choose the Electives from the four Specializations available (HR, Finance, Marketing, Systems).

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Elective	Human Resource Management	FINANCE	MARKETING	SYSTEMS
Elective – I:	Leadership and Change Management (194HR3E01)	Investment Analysis and Portfolio Management (194FI3E01)	Consumer Behavior (194MA3E01)	Data Mining for Business Decisions (194SY3E01)
Elective – II	Performance Evaluation and Compensation Management (194HR3E02)	Managing Banks and Financial Institutions (194FI3E02)	Retail Management (194MA3E02)	Managing Software Projects (194SY3E02)
Elective – III	Human Capital Management (194HR3E03)	Financial Markets and Services (194FI3E03)	Strategic Marketing Management (194MA3E03)	Web Designing (194SY3E03)
Elective – IV	Manpower Planning, Recruitment, and Selection (194HR3E04)	Taxation (194FI3E04)	Digital and Social Media Marketing (194MA3E04)	Business Analytics (194SY3E04)
Elective – V	Labour Welfare and employment laws (194HR4E05)	Financial Derivatives (194FI4E05)	Services Marketing (194MA4E05)	Big Data Analytics (194SY4E05)
Elective – VI	International HRM (194HR4E06)	Global Financial Management (194FI4E06)	Promotional and Distribution Management (194MA4E06)	Enterprise Resource Planning (194SY4E06)
Elective – VII	Employee Relations and Engagement (194HR4E07)	Risk Management (194FI4E07)	Green Marketing (194MA4E07)	Cyber Laws & Security (194SY4E07)
Elective – VIII	Strategic HRM (194HR4E08)	Behavioral Finance (194FI4E08)	Global Marketing Management (194MA4E08)	Artificial Intelligence and Machine Learning (194SY4E08)

Open Electives:

OPEN ELECTIVE-I		
S. No	Course Code	Name of the Course
1	194MB1O01	Cross Cultural Management.
2	194MB1O02	Rural Innovation Projects.
3	194MBMOOC1	MOOCs: SWAYAM/NPTEL related to Management Courses other than listed courses in the syllabus.

OPEN ELECTIVE-II		
S. No	Course Code	Name of the Course
1	194MB2O04	Project Management.
2	194MB2O05	Technology Management.
3	194MB2O06	Lean Management.
4	194MB2O07	Data base Management System.

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Syllabus revision Index (2021-22)

S.No	Name of the course	Percentage of syllabus change
1.	Lean Management.	20
2.	Data base Management System.	20

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LEAN MANAGEMENT

II Semester **L T P C**
Course Code: 194MB2O06 **4 0 0 4**

Course Objectives:

COB 1: To understand issues and challenges in implementing and development in lean manufacturing techniques from TPS and its contribution for improving organizational performance.

COB 2: To acquaint the students about various issues on quality improvement in the process of Production.

Course Outcomes:

At the end of the Course, Student will be able to:

CO 1 : Understand and apply the various types of new production systems.

CO 2 : Analyze and apply the suitable techniques to improve the quality in process of production.

CO 3 : Analyze and apply the standards in Lean system.

CO 4 : Apply the standardization of total productive maintenance.

CO 5 : Analyze and apply the Hoshin planning system.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO 1 (K3)	PO 2 (K4)	PO 3 (K5)	PO 4 (K5)	PO 5 (K3)	PO 6 (K4)	PO 7 (K3)	PO 8 (K3)	PO 9 (K3)	PO 10 (K3)	PO11 (K4)
CO1 (K3)	3	-	2	-	-	-	-	-	-	-	-
CO2 (K4)	-	-	-	2	3	-	-	-	-	-	-
CO3 (K3)	-	-	3	-	-	-	-	-	-	-	2
CO4 (K3)			2		-	-	-	-	-	-	2
CO5 (K3)	-	-		2	-	-	-	-	3	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K4)	PSO 3(K4)
CO1 (K3)	3	-	-
CO2 (K4)	2	-	-
CO3 (K3)	3	-	-
CO4 (K3)	3	-	-
CO5 (K3)	3	-	-

UNIT- I:

Introduction: Mass production system, Craft Production, Origin of Lean production system, Why Lean production, Lean revolution in Toyota, Systems and systems thinking, Basic image of lean production, Customer focus, Waste Management.

UNIT- II:

Just In Time: Why JIT, Basic Principles of JIT, JIT system, Kanban, Six Kanban rules, Expanded role of conveyance, Production leveling, Three types of Pull systems, Value stream mapping. JIDOKA, Development of Jidoka concept, Why Jidoka, Poka, Yoke systems, Inspection systems and zone control – Types and use of Poka-Yoke systems, Implementation of Jidoka.

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DATA BASE MANAGEMENT SYSTEM

II Semester
Course Code: 194MB2O07

L	T	P	C
4	0	0	4

Course Objectives:

COB 1: To emphasis on DBMS and how to organize, maintain and retrieve efficiently, and effectively - information from a DBMS.

COB 2: To make students able to understand and apply the DBMS tools and techniques effectively.

Course Outcomes:

At the end of the Course, Student will be able to:

CO 1: Understand and apply the data models of DBMS.
CO 2: Analyze and apply the ER and Relational models.
CO 3: Understand and Apply the Data Definition and Querying,
CO 4: Understand and Apply the Transactions and Concurrency.
CO 5: Understand and Apply the Advanced Topics in Databases.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO 1 (K3)	PO 2 (K4)	PO 3 (K5)	PO 4 (K5)	PO 5 (K3)	PO 6 (K4)	PO 7 (K3)	PO 8 (K3)	PO 9 (K3)	PO 10 (K3)	PO11 (K4)
CO1 (K3)	3	-	2	-	-	-	-	-	-	-	-
CO2 (K4)	2	-	-	3	3	-	-	-	-	-	-
CO3 (K3)	3	-	3	-	-	-	-	-	-	-	2
CO4 (K3)	3		2		-	-	-	-	-	-	2
CO5 (K3)	3	-	-	2	-	-	-	-	3	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K4)	PSO 3(K4)
CO1 (K3)	3	-	-
CO2 (K4)	2	-	-
CO3 (K3)	3	-	-
CO4 (K3)	3	-	-
CO5 (K3)	3	-	-

UNIT- I:

Introduction to Database Systems: Data - Database Applications - Evolution of Database - Need for Database Management – Data models - Database Architecture - Key Issues and Challenges in Database Systems.

UNIT -II:

ER and Relational Models: ER Models – ER to Relational Mapping –Object Relational Mapping – Relational Model Constraints - Keys - Dependencies - Relational Algebra - Normalization - First, Second, Third & Fourth Normal Forms - BCNF – Join Dependencies.

UNIT- III:

Data Definition and Querying: Basic DDL - Introduction to SQL - Data Constraints - Advanced SQL – Views - Triggers - Database Security – Embedded & Dynamic SQL.

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1.1.2. Table-Prior/Post revision of syllabus(2021-22)

Regulation	Pre-Revision	Post-Revision
Course Title	Lean Management.	Lean Management.
Course Code	194MB2O06	194MB2O06
Syllabus	UNIT- I: Introduction: Mass production system, Craft Production, Origin of Lean production system, Why Lean production, Lean revolution in Toyota, Systems and systems thinking, Basic image of lean production, Customer focus, Waste Management.	UNIT- I: Introduction: Mass production system, Craft Production, Origin of Lean production system, Why Lean production, Lean revolution in Toyota, Systems and systems thinking, Basic image of lean production, Customer focus, Waste Management.
	UNIT- II: Just In Time: Why JIT, Basic Principles of JIT, JIT system, Kanban, Six Kanban rules, Expanded role of conveyance, Production leveling, Three types of Pull systems, Value stream mapping. JIDOKA, Development of Jidoka concept, Why Jidoka, Poka, Yoke systems, Inspection systems and zone control – Types and use of Poka-Yoke systems, Implementation of Jidoka	UNIT- II: Just In Time: Why JIT, Basic Principles of JIT, JIT system, Kanban, Six Kanban rules, Expanded role of conveyance, Production leveling, Three types of Pull systems, Value stream mapping. JIDOKA, Development of Jidoka concept, Why Jidoka, Poka, Yoke systems, Inspection systems and zone control – Types and use of Poka-Yoke systems, Implementation of Jidoka
	UNIT -III: Kaizen: Six – Sigma philosophy and Methodologies, QFD, FMEA Robust Design concepts; SPC, QC circles standardized work in lean system, Standards in the lean system, 5S system.	UNIT -III: Kaizen: Six – Sigma philosophy and Methodologies, QFD, FMEA Robust Design concepts; SPC, QC circles standardized work in lean system, Standards in the lean system, 5S system.
	UNIT- IV: Total Productive Maintenance: Why Standardized work, Elements of standardized work, Charts to define standardized work, Kaizen and Standardized work Common layouts.	UNIT IV PROJECT SELECTION FOR LEAN Resource and project selection, Selecting projects, Process mapping, Current and future value stream mapping, project suitable for lean initiatives.
	UNIT- V: Hoshin Planning & Lean	UNIT- V: Hoshin Planning & Lean

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1.1.2. Table-Prior/Post revision of syllabus (2021-22)

Regulation	Pre-Revision	Post-Revision
Course Title	Data base Management System	Data base Management System
Course Code	194MB2O07	194MB2O07
Syllabus	UNIT- I: Introduction to Database Systems: Data - Database Applications - Evolution of Database - Need for Database Management – Data models - Database Architecture - Key Issues and Challenges in Database Systems.	UNIT- I: Introduction to Database Systems: Data - Database Applications - Evolution of Database - Need for Database Management – Data models - Database Architecture - Key Issues and Challenges in Database Systems.
	UNIT -II: ER and Relational Models: ER Models – ER to Relational Mapping –Object Relational Mapping – Relational Model Constraints - Keys - Dependencies - Relational Algebra - Normalization - First, Second, Third & Fourth Normal Forms - BCNF – Join Dependencies.	UNIT -II: ER and Relational Models: ER Models – ER to Relational Mapping Introduction to Protocols for Concurrency Control in Databases : Two-Phase Locking Techniques for Concurrency Control-Types of Locks and System Lock Tables.
	UNIT- III: Data Definition and Querying: Basic DDL - Introduction to SQL - Data Constraints - Advanced SQL – Views - Triggers - Database Security – Embedded & Dynamic SQL	UNIT- III: Data Definition and Querying: Basic DDL - Introduction to SQL - Data Constraints - Advanced SQL – Views - Triggers - Database Security – Embedded & Dynamic SQL
	UNIT -IV: Transactions and Concurrency: Introduction to Transactions - Transaction Systems - ACID Properties – System & Media Recovery - Need for Concurrency - Locking Protocols – SQL for Concurrency – Log Based Recovery - Two Phase Commit Protocol - Recovery with SQLDeadlocks &	UNIT -IV: Transactions and Concurrency: Introduction to Transactions - Transaction Systems - ACID Properties – System & Media Recovery - Need for Concurrency - Locking Protocols – SQL for Concurrency – Log Based Recovery - Two Phase Commit Protocol - Recovery with SQLDeadlocks & Managing

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