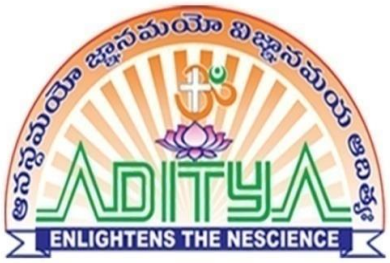
PROGRAM STRUCTURE AND SYLLABUS

SOFTWARE ENGINEERING

For

M.TECH.TWO YEARS DEGREE PROGRAM

(Applicable to the batches admitted from 2019-20)



ADITYA ENGINEERING COLLEGE

An Autonomous Institution

Approved by AICTE, Affiliated to JNTUK & Accredited by NBA, NAAC with 'A' Grade
Recognized by UGC under the sections 2(f) and 12(B) of UGC act 1956
Aditya Nagar, ADB Road, SURAMPALEM - 533 437

VISION & MISSION OF THE COLLEGE

VISION

To induce higher planes of learning by imparting technical education with,

- International standards
- Applied research
- Creative ability
- Value based instruction andto emerge as a premier institute.

MISSION

Achieving academic excellence by providing globally acceptable technical education by forecasting technology through

- Innovative research & development
- Industry institute interaction
- Empowered manpower

VISION & MISSION OF THE DEPARTMENT

VISION

To achieve global standards in quality of education, research and development by producing technically competent and innovative IT Professionals.

MISSION

M1: Providing an academic environment in which students are given the essential resources for solving real-world problems and work in multidisciplinary teams.

M2: Imparting value based education and research orientations for sustained growth in technological aspects and leadership qualities.

M3: Collaborating with the industry for making the students adoptable to evolving changes in Information Technology and related areas.

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of the Program will

PEO 1	Demonstrate an exceptional involvement and active participation in Research and Development leading to new innovations and optimized solutions in the field of software engineering for a better career.
PEO 2	Develop solutions professionally by adapting to the dynamic needs of Industry, Academia or Research in the field of Software Engineering.
PEO 3	Adapt to different roles and responsibilities in multidisciplinary working environment by respecting professionalism and ethical practices within organization and society at national and international level.

PROGRAM OUTCOMES (POs)

After successful completion of the program, the graduates will be able to

PO 1	**Scholarship of Knowledge:** Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.
PO 2	**Critical Thinking:** Analyze complex engineering problems critically, apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.
PO 3	**Problem Solving:** Think laterally and originally, conceptualize and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.
PO 4	**Research Skill:** Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.
PO 5	**Usage of modern tools:** Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations.
PO 6	**Collaborative and Multidisciplinary work:** Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.

PO 7	**Project Management and Finance:** Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors.
PO 8	**Communication**: Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.
PO 9	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.
PO 10	**Ethical Practices and Social Responsibility:** Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.
PO 11	**Independent and Reflective Learning:** Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

PROGRAM SPECIFIC OUTCOMES (PSOs)

After successful completion of the program, the graduates will be able to

PSO 1	Apply the knowledge of computer science and software engineering to provide solutions to real world problems.
PSO 2	Conduct investigations to identify research gaps and address complex engineering problems in software engineering domain.
PSO 3	Apply appropriate techniques, use modern programming languages, tools and packages for quality software development by thorough hunder standing of needs under given constraints.

Mission of the department – PEOs mapping

PEO's Statements		M1	M2	M3
PEO 1:	Demonstrate an exceptional involvement and active participation in Research and Development leading to new innovations and optimized solutions in the field of software engineering for a better career.	2	3	1
PEO 2:	Develop solutions professionally by adapting to the dynamic needs of Industry, Academia or Research in the field of Software Engineering.	3	3	1
PEO 3:	Adapt to different roles and responsibilities in multidisciplinary working environment by respecting professionalism and ethical practices within organization and society at national and international level.	3	3	3

Note:.

Bloom's Taxonomy Knowledge Level	Knowledge Level Representation		Mapping / Correlation levels
Remember	K1		1: Slight (Low)
Understand	K2		
Apply	K3		2: Moderate (Medium)
Analyse	K4		
Evaluate	K5		3: Substantial (High)
Create	K6		

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	
192SE1T01	Software Engineering	PCC	3	0	0	3	3
192SE1T02	Advanced Data Structures	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
192SE1L01	Advanced Data Structures Lab	PCC	0	0	4	4	2
192SE1L02	Software Engineering Lab-I	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	
192SE2T03	Service Oriented Architecture	PCC	3	0	0	3	3
192SE2T04	Mathematical Foundations of Computer Science	PCC	3	0	0	3	3
---	Professional Elective-III	PEC	3	0	0	3	3
---	Professional Elective-IV	PEC	3	0	0	3	3
192SE2L03	Software Testing Lab	PCC	0	0	4	4	2
192SE2L04	Software Engineering Lab-II	PCC	0	0	4	4	2
192SE2P01	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
192SE3P02	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	
192SE4P03	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	192SE1E01	Software Project and Process Management
2	192SE1E02	Machine Learning
3	192SE1E03	E-Commerce

Professional Elective – II (I Semester)		
S.No	**Course Code**	**Name of the Course**
1	192SE1E04	Software Quality Assurance and Testing
2	192SE1E05	Cloud Computing
3	192SE1E06	Internet of Things

Professional Elective – III (II Semester)		
S.No	**Course Code**	**Name of the Course**
1	192SE2E06	Software Testing Methodologies
2	192SE2E07	Agile Software Development
3	192SE2E08	ERP & Supply Chain Management

Professional Elective – IV (II Semester)		
S.No	**Course Code**	**Name of the Course**
1	192SE2E09	Secure Software Engineering
2	192SE2E10	Big Data Analytics
3	192SE2E11	Design patterns

Professional Elective – V (III Semester)		
S.No	**Course Code**	**Name of the Course**
1	192SE3E12	Object Oriented Software Engineering
2	192SE3E13	Artificial Intelligence
3	192SE3E14	User Interface 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**.**

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

SOFTWARE ENGINEERING

I Semester	**L**	**T**	**P**	**C**
Course Code: 192SE1T01	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To discuss the role of software, aim of the software system, different types of process models.
COB 2: To make the students use process models in project, software requirement specification, Requirement and analysis, planning of a software project, estimations, Risk management.
COB 3: To illustrate the role of software architecture, architecture views and Architecture styles for C&C view, evaluating architectures.
COB 4: To provide the knowledge on the design concepts, function-oriented design, object oriented design, and metrics.
COB 5: To make the students develop code for system, different types of testings' applying on developed system.

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

CO 1: Demonstrate knowledge on fundamentals of software engineering, process models and SDLC.
CO 2: Analyze software requirements and process models required to develop a software system.
CO 3: Design and a quality software product using design engineering principles and Develop software product as per user and societal requirements.
CO 4: Illustrate standards for software development and quality management.
CO 5: Demonstrate skills in applying risk and quality management principles for effective management of software projects.

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	2	3	-	-	-	-
CO2 (K4)	3	3	2	2	3	-	-	-	-	-	-
CO3 (K6)	3	3	3	3	3	-	-	-	-	-	-
CO4 (K2)	2	1	-	-	2	2	3	-	-	-	-
CO5 (K2)	2	1	-	-	2	2	3	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K2)
CO1 (K2)	-	-	3
CO2 (K4)	-	2	-
CO3 (K6)	3	3	-
CO4 (K2)	3	3	3
CO5 (K2)	3	3	3

UNIT-I:

Software and Software Engineering:

The Nature of Software, The Unique Nature of Web Apps, Software Engineering, Software Process, Software Engineering Practice, Software Myths.

Process Models:

A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Terminology, Product and Process.

UNIT-II:

Requirements Analysis And Specification:

Requirements Gathering and Analysis, Software Requirement Specification (SRS), Formal System Specification.

Software Design:

Overview of the Design Process, How to Characterize of a Design?, Cohesion and Coupling, Layered Arrangement of Modules, Approaches to Software Design.

UNI T-III:

Function-Oriented Software Design:

Overview of SA/SD Methodology, Structured Analysis, Developing the DFD Model of a System, Structured Design, Detailed Design, Design Review, over view of Object Oriented design.

User Interface Design:

Characteristics of Good User Interface, Basic Concepts, Types of User Interfaces, Fundamentals of Component-based GUI Development, A User Interface Design Methodology.

UNIT-IV:

Coding and Testing:

Coding, Code Review, Software Documentation, Testing, Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Program Analysis Tool, Integration Testing, Testing Object-Oriented Programs, System Testing, Some General Issues Associated with Testing

UNIT-V:

Software Reliability and Quality Management:

Software Reliability, Statistical Testing, Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity Model.

Computer Aided Software Engineering:

Case and its Scope, Case Environment, Case Support in Software Life Cycle, Other Characteristics of Case Tools, Towards Second Generation CASE Tool, Architecture of a Case Environment.

Text Books:

1. Software Engineering A practitioner’s Approach, Roger S. Pressman, Seventh Edition McGraw Hill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, Third Edition, PHI.
3. Software Engineering, Ian Sommerville, Ninth edition, Pearson education.

Reference Books:

1. Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill,2008.
2. Software Engineering, A Precise Approach, PankajJalote, Wiley India,2010.
3. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
4. Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition, 2006.

Web Links:

1. http://nptel.ac.in/courses/106101061/
2. https://www.coursera.org/learn/software-processes-and-agile-practices
3. https://in.udacity.com/auth/?next=/course/software-development-processud805
4. http://www.geeksforgeeks.org/software-engineering-gq/
5. https://www.tutorialspoint.com/software_engineering/

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ADVANCED DATA STRUCTURES

I Semester	**L**	**T**	**P**	**C**
Course Code: 192SE1T02	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To provide knowledge on single Linked, Double Linked Lists, Stacks, Queues, Searching and Sorting techniques, Trees, Binary trees, representation, traversal, Graphs- storage, traversal.

COB 2: To make the students implement dictionaries, ADT for List, Stack, Queue, Hash table representation, Hash functions, Priority queues, Priority queues using heaps, Search trees.

COB 3: To teach the concepts of AVL trees, operations of AVL trees, Red-Black trees, Splay trees, comparison of search trees.

Course Outcomes:

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

CO 1: Analyze algorithms for algorithm correctness and efficiency.

CO 2: Apply a variety of advanced abstract data type (ADT) and data structures and their Implementation.

CO 3: Demonstrate various searching, sorting and hash techniques and be able to apply and solve problems of real life.

CO 4: Design and implement variety of data structures including linked lists, binary trees, heaps, graphs and search trees.

CO 5: Compare various search trees and find solutions for IT related problems.

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 (K4)	3	3	3	3	3	3	-	-	-	-	-
CO2 (K3)	3	2	3	3	3	3	-	-	-	-	-
CO3 (K2)	2	-	-	-	2	2	3	-	-	-	-
CO4 (K6)	-	3	3	-	-	-	-	-	-	-	-
CO5 (K2)	2	-	-	-	2	2	3	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K2)
CO1 (K4)	2	-	-
CO2 (K3)	3	3	3
CO3 (K2)	2	-	-
CO4 (K6)	-	3	3
CO5 (K2)	3	-	-

UNIT-I:

Introduction to Data Structures: Singly Linked Lists, Doubly Linked Lists, Circular Lists-Algorithms.

Stacks and Queues: Algorithm Implementation using Linked Lists.

UNIT-II:
Searching: Linear and Binary, Search Methods
Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort
Trees: Binary trees, Operations- Insertion, Deletion, Properties, Representation and Traversals (DFT, BFT), Expression Trees (Infix, prefix, postfix).
Graphs: Basic Concepts, Storage structures and Traversals.

UNIT-III:
Dictionaries: Dictionaries, ADT, The List ADT, Stack ADT, Queue ADT, Hash Table Representation, Hash Functions, Collision Resolution-Separate Chaining.
Open Addressing: Linear Probing, Double Hashing.

UNIT-IV:
Priority Queues: Definition, ADT, Realising a Priority Queue Using Heaps, Definition, Insertion, Deletion.
Search Trees: Binary Search Trees, Definition, ADT, Implementation,
Operations: Searching, Insertion, Deletion.

UNIT-V:
Search Trees: AVL Trees, Definition, Height of AVL Tree, Operations- Insertion, Deletion and Searching. Introduction to Red-Black and Splay Trees, B-Trees, Height of B-Tree, Insertion, Deletion and Searching, Comparison of Search Trees.

Text Books:

1. Software Engine Data Structures: A Pseudocode Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon, Cengage.
2. Data Structures, Algorithms and Applications in java, 2/e, Sartaj Sahni, University Press.

Reference Books:

1. Data Structures And Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson
2. Data Structures And Algorithms, 3/e, Adam Drozdek, Cenage.
3. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering Examples, N. B. Venkateswarulu, E.V. Prasad, S Chand & Co, 2009.
4. Classic Data Structures, Second Edition, Debasis Samantha, PHI.

Web Links:

1. https://ocw.mit.edu/courses/...and...datastructures...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

SOFTWARE PROJECT AND PROCESS MANAGEMENT
(Professional Elective-I)

I Semester	L	T	P	C
Course Code:192SE1E01	3	0	0	3

Course Objectives:

COB 1: To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project.
COB 2: To compare and differentiate organization structures and project structures.
COB 3: To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools.

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

CO 1: Apply the process to be followed in the software development life-cycle models.
CO 2: Implement communication, modeling, and construction & deployment practices in software development.
CO 3: Analyze the software models using unified modelling language (UML) and the concepts of various software testing methods.
CO 4: Apply appropriate testing approaches for development of software and use the quality management metrics in software development.
CO 5: Apply the concepts of project management & planning.

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 (K3)	3	3	1	1	-	3	1	-	-	-	-
CO2 (K2)	2	1	-	-	-	-	3	-	-	-	-
CO3 (K6)	3	-	3	3	-	-	-	-	-	-	-
CO4 (K3)	3	2	1	1	-	3	-	-	-	-	-
CO5 (K3)	3	3	1	1	-	3		-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K2)
CO1 (K3)	3	-	-
CO2 (K2)	2	2	3
CO3 (K6)	-	-	-
CO4 (K3)	3	3	2
CO5 (K3)	3	3	-

UNIT-I:
Software Process Maturity Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process. Process Reference Models Capability Maturity Model (CMM), CMMi, PCMM, PSP, TSP.

UNIT-II:

Searching:

Software Project Management Renaissance Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way.

UNI T-III:

Life-Cycle Phases and Process artifacts Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model based software architectures. Workflows and Checkpoints of process Software process workflows, Iteration workflows, Major milestones, minor milestones, periodic status assessments.

UNIT-IV:

Process Planning and Project Organizations Work breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning, line-of- business organizations, project organizations, evolution of organizations, process automation.

UNIT-V:

Project Control and process instrumentation. The seven core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, metrics automation. CCPDS-R Case Study and Future Software Project Management Practices Modern Project Profiles, Next- Generation software Economics, Modern Process Transitions.

Text Books:

1. Managing the Software Process, Watts S. Humphrey, Pearson Education, 1999.
2. Software Project Management, Walker Royce, PearsonEducation,1998.

Reference Books:

1. An Introduction to the Team Software Process, Watts S. Humphrey, Pearson Education,2000.
2. Process Improvement essentials, James R. Persse, O'Reilly,2006.
3. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, Tata Mc-Graw Hill,2006.
4. Applied Software Project Management, Andrew Stellman& Jennifer Greene, O'Reilly, 2006.
5. Head First PMP, Jennifer Greene & Andrew Stellman, O'Reilly,2007.

Web Links:

1. https://onlinecourses.nptel.ac.in/noc18_mg08/preview.
2. https://www.coursera.org/specializations/product-management
3. https://www.tutorialspoint.com/software_engineering/software_project_ management.
4. https://www.scribd.com/doc/7102316/Software-Project-Management.
5. https://in.udacity.com/course/software-development-process--ud805

MACHINE LEARNING
(Professional Elective-I)

I Semester **L T P C**
Course Code: 192SE1E02 **3 0 0 3**

Course Objectives:

COB 1: To make the students identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
COB 2: To enable the students to formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).
COB 3: To teach basic AI algorithms (e.g., standard search algorithms or dynamic programming).
COB 4: To make the students design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

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

CO 1: Explain the models, classification, scoring and ranking estimations.
CO 2: Apply supervised, unsupervised and concept learning in solving real time problems.
CO 3: Make use of Tree based and Rule based models in classification and regression problems.
CO 4: Experiment with linear and distance based models in solving classification, regression and clustering problems.
CO 5: Utilize probabilistic models, to predict probability distribution over a set of classes on a given observation.

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 (K3)	3	2	1	-	3	3	2	-	-	-	-
CO3 (K3)	3	2	1	-	3	-	-	-	-	-	-
CO4 (K3)	3	2	1	-	3	3	2	-	-	-	-
CO5 (K3)	3	2	1	-	3	3	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K2)
CO1 (K2)	2	2	3
CO2 (K3)	3	3	2
CO3 (K3)	3	3	2
CO4 (K3)	3	3	2
CO5 (K3)	3	3	2

UNIT-I:

Introduction:

Towards Intelligent Machines, Well posed Problems, Example of Applications in diverse fields, Data Representation, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured / Unstructured, Forms of Learning, Machine Learning and Data Mining, Basic Linear Algebra in Machine Learning Techniques.

UNIT-II:

Supervised Learning:

Rationale and Basics: Learning from Observations, Bias and Why Learning Works: Computational Learning Theory, Occam's Razor Principle and Overfitting Avoidance Heuristic Search in inductive Learning, Estimating Generalization Errors, Metrics for assessing regression, Metris for assessing classification.

UNIT-III:

Statistical Learning:

Machine Learning and Inferential Statistical Analysis, Descriptive Statistics in learning techniques, Bayesian Reasoning: A probabilistic approach to inference, K-Nearest Neighbor Classifier. Discriminant functions and regression functions, Linear Regression with Least Square Error Criterion, Logistic Regression for Classification Tasks, Fisher's Linear Discriminant and Thresholding for Classification, Minimum Description Length Principle.

UNIT-IV:

Priority queues Support Vector Machines (SVM):

Introduction, Linear Discriminant Functions for Binary Classification, Perceptron Algorithm, Large Margin Classifier for linearly separable data, Linear Soft Margin Classifier for Overlapping Classes, Kernel Induced Feature Spaces, Nonlinear Classifier, Regression by Support vector Machines.

Learning with Neural Networks: Towards Cognitive Machine, Neuron Models, Network Architectures, Perceptron's, Linear neuron and the Widrow-Hoff Learning Rule, The error correction delta rule.

UNIT-V:

Multilayer Perceptron Networks and error back propagation algorithm, Radial Basis Functions Networks.

Decision Tree Learning: Introduction, Example of classification decision tree, measures of impurity for evaluating splits in decision trees, ID3, C4.5, and CART decision trees, pruning the tree, strengths and weakness of decision tree approach.

Text Books:

1. Applied Machine Learning, M.Gopal, McGraw Hill Education.
2. Machine Learning: A Probabilistic Perspective, Kevin Murphy, MIT Press,2012.
3. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer 2009 (freely available online).

Reference Books:

1. Pattern Recognition and Machine Learning, Christopher Bishop, Springer,2007.
2. Programming Collective Intelligence: Building Smart Web 2.0Applications – Toby Segaran.
3. Building Machine Learning Systems with Python – Willi Richert, Luis Pedro Coelho.

Web Links:

1. https://www.coursera.org/learn/machine-learning
2. https://classroom.udacity.com/courses/ud120
3. http://videolectures.net/Top/Computer_Science/Machine_Learning/
4. https://onlinecourses.nptel.ac.in/noc18_cs26
5. https://www.youtube.com/channel/UCR4_akQ1HYMUcDszPQ6jh8Q

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E-COMMERCE
(Professional Elective-I)

I Semester	L	T	P	C
Course Code:192SE1E03	3	0	0	3

Course Objectives:

COB 1: To teach the basic concepts of information systems for business and management.
COB 2: To illustrate the concepts of organizational and managerial foundations of systems.
COB 3: To provide knowledge on technical foundation for understanding information systems.

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

CO 1: Demonstrate an understanding of the foundations and importance of Ecommerce.
CO 2: Analyze the impact of E-commerce on business models and strategy.
CO 3: Explain Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational.
CO 4: Illustrate the infrastructure for E-commerce and describe the key features of Internet, Intranets and Extranets and explain how they relate to each other.
CO 5: Assess electronic payment systems and Recognize and discuss global Ecommerce issues.

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	-	-	-	2	2	-	-	-	-	-
CO2 (K4)	1	3	2	-	1	-	-	-	-	-	-
CO3 (K2)	2	1	-	-	2	2	-	-	-	-	-
CO4 (K2)	2	1	-	-	2	2	-	-	-	-	-
CO5 (K5)	-	3	3	-	-	1	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K2)
CO1 (K2)	2	2	3
CO2 (K4)	-	-	-
CO3 (K2)	2	2	3
CO4 (K2)	2	2	3
CO5 (K5)	-	-	-

UNIT-I:
Electronic Commerce, Frame work, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications. Consumer Oriented Electronic commerce, Mercantile Process models.

UNIT-II:
Electronic payment systems-Digital Token Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.

UNIT-III:
Inter Organizational Commerce-EDI, EDI Implementation, Value added networks. Intra Organizational Commerce-work Flow, Automation Customization and internal Commerce, Supply chain Management.

UNIT-IV:
Corporate Digital Library - Document Library, digital Document types, corporate Data Warehouses. Advertising and Marketing, Information based marketing, Advertising on Internet, on-line marketing process, market research.

UNIT-V:
Consumer Search and Resource Discovery, Information search and Retrieval, Commerce Catalogues, Information Filtering. Multimedia –key multimedia concepts, Digital Video and electronic Commerce, Desktop video processing's, Desktop video conferencing.

Text Books:

1. Frontiers of Electronic Commerce, Kalakata, Whinston, PEA.

Reference Books:

1. E-Commerce Fundamentals and Applications, Hendry Chan, Raymond Lee, Dillon, Chang, John Wiley.
2. E-Commerce, A Managerial Perspective, Turban E, LeeJ, King, Chung H.M, PEA, 2001.
3. E-Commerce an Indian Perspective,3/e, P.T. Joseph, PHI,2009.
4. E-Commerce, S.Jaiswal, Galgotia.
5. Electronic Commerce, Gary P.Schneider, Thomson.

Web Links:

1. https://ecommerceguide.com/guides/what-is-ecommerce/
2. https://bigcommerce.com/blog/ecommerce/
3. https://www.britannica.com/technology/e-commerce
4. https://feinternational.com/blog/what-is-e-commerce-an-introduction-to-theindustry/
5. https://www.managementstudyguide.com/e-commerce-and-internet.htm

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SOFTWARE QUALITY ASSURANCE AND TESTING
(Professional Elective-II)

I Semester	**L**	**T**	**P**	**C**
Course Code: 192SE1E04	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To teach the basic concepts of software quality assurance and testing as a fundamental component of software lifecycle.
COB 2: To illustrate the scope of software projects.
COB 3: To make the students apply software quality assurance and testing activities using modern software tools.
COB 4: To implement the techniques to estimate cost of a project and manage budgets and prepare test plans and schedules for a software quality assurance and testing project.
COB 5: To make the students develop software quality assurance and testing project staffing requirements and effectively manage a project.

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

CO 1: Apply modern software testing processes in relation to software development and project management.
CO 2: Create test strategies and plans, design test cases, prioritize and execute them.
CO 3: Identify incidents and risks within a project.
CO 4: Illustrate about efficient delivery of software solutions and implement improvements in the software development processes.
CO 5: Design computer based systems and IT processes.

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	-	-	-	2	-	3	-	-	-	-
CO2 (K6)	-	1	3	3	-	-	-	-	-	-	-
CO3 (K3)	2	2	-	-	2	-	1	-	-	-	-
CO4 (K2)	3	-	-	-	3	-	3	-	-	-	-
CO5 (K6)	-	3	3	3	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K2)
CO1 (K2)	3	3	3
CO2 (K6)	-	-	-
CO3 (K3)	3	3	1
CO4 (K2)	3	3	3
CO5 (K6)	-	-	-

UNIT-I:
Software quality assurance Framework and Standards SQA Frame Work: What is Quality? Software Quality Assurance. Components of Software quality Assurance. Singly Linked Lists, Doubly Linked Lists, Circular Lists-Algorithms.
Software Quality Assurance Plan: Steps to develop and implement a Software quality Assurance Plan.

Standards: ISO9000, CMM, CMMI, PCMM, Malcom Balridge, 3 Sigma, 6 Sigma.

UNIT-II:
Software Quality Assurance Metrics and Measurement Software Quality Assurance Metrics:
Product Quality metrics, In- Process Quality metrics, Metrics for Software Maintenance. Examples of Metric Programs, Software quality indicators Fundamentals in Measurement Theory.

UNIT-III:
Building Software Testing Environment:
Writing Policy for software testing, Economics of testing, Building a structured approach to software testing.
Software Testing process: Defects Hard to find, Functional and structured testing, Workbench concept, customizing the software testing process, testing tactics check list.

UNIT-IV:
Software Testing Techniques:
Black-Box testing, Boundary value analysis, Bottom-up, Branch Coverage, Cause-Effect graphing, CRUD, Database, exception, Gray_box, Histogram, Inspections, JADs, Pareto Analysis, prototyping, random Testing, Risk based Testing, Regression Testing, Structured Walkthrough, Thread testing, Performance Testing, White Box Testing .
Software Testing Tools: Taxonomy of Testing tools, Methodology to evaluate automated testing tools, Load Runner, Win Runner and Rational Testing Tools, Java testing Tools, J Metra, JUNIT and Cactus

UNIT-V:
Testing Process:
Advantages of following a process, Cost of computer testing, Seven step software Testing Process, Define the scope of testing, Developing the test plan, Verification Testing. Validation Testing, Analysing and reporting test results, Acceptance and operational Testing, Post Implementation Analysis.
Testing Specialised Systems and Applications: Testing Client/Server System, Testing COTS and Contracted Software, Testing security, Testing Data Warehouse.

Text Books:
1. William E.Perry: Effective Methods for Software Testing, 3rd Edition, Wiley Publication.

Reference Books:
1. Testing and Quality Assurance for Component-based Software, by Gao, Tsao and Wu, Artech House Publishers.
2. Software Testing Techniques, by Bories Beizer, Second Edition, Dreamtech Press.
3. Managing the Testing Process, by Rex Black, Wiley.

Web Links:

1. www.softwaretestinghelp.com/web-application-testing
2. www.computersciencezone.org/software-quality-assurance/
3. http://www.softwareqatest.com/
4. https://dl.acm.org/citation.cfm?id=811110
5. https://testinginstitute.com/display.php

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CLOUD COMPUTING
(Professional Elective-II)

I Semester	L	T	P	C
Course Code: 192SE1E05	3	0	0	3

Course Objectives:

COB 1: To make the students demonstrate the cloud environment, building software systems and components that scale to millions of users in modern internet.
COB 2: To teach the students Cloud concepts capabilities across the various cloud service models including Iaas, Paas, Saas.
COB 3: To illustrate the developing cloud based software applications on top of cloud platforms.

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

CO 1: Explain various service delivery models of a cloud computing architecture.
CO 2: Apply concept of Map-Reduce and how Map-Reduce works in analysis of data in parallel computing.
CO 3: Apply various Cloud Technologies, web services and software involved in cloud computing to design enterprise applications.
CO 4: Illustrate the challenges involved in cloud computing security and how VMs can be secured in Virtualization security management.

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	-	3	-	-	3	-
CO2 (K3)	3	2	1	-	3	-	-	-	-	-	-
CO3 (K3)	3	2	1	-	3	-	-	-	-	-	-
CO4 (K2)	2	1	-	-	2	-	3	-	-	3	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K2)
CO1 (K2)	1	1	3
CO2 (K3)	3	3	-
CO3 (K3)	3	3	-
CO4 (K2)	1	1	3

UNIT-I:
Introduction:
Network centric computing, Network centric content, peer-to –peer systems, cloud computing delivery models and services, Ethical issues, Vulnerabilities, Major challenges for cloud computing.
Parallel and Distributed Systems: Introduction, architecture, distributed systems, communication protocols, logical clocks, message delivery rules, concurrency, model concurrency with Petri Nets.

UNIT-II:

Cloud Infrastructure:

At Amazon, The Google Perspective, Microsoft Windows Azure, Open Source Software Platforms, Cloud storage diversity, Intercloud, energy use and ecological impact, responsibility sharing, user experience, Software licensing.

Cloud Computing: Applications and Paradigms: Challenges for cloud, existing cloud applications and new opportunities, architectural styles, workflows, The Zookeeper, The Map Reduce Program model, HPC on cloud, biological research

UNIT-III:

Cloud Resource Virtualization:

Virtualization, layering and virtualization, virtual machine monitors, virtual machines, virtualization- full and para, performance and security isolation, hardware support for virtualization, Case Study: Xen, v Blades.

Cloud Resource Management and Scheduling: Policies and Mechanisms, Applications of control theory to task scheduling, Stability of a two-level resource allocation architecture, feed back control based on dynamic thresholds, coordination, resource bundling, scheduling algorithms, fair queuing, start time fair queuing, cloud scheduling subject to deadlines, Scheduling Map Reduce applications, Resource management and dynamic application scaling

UNIT-IV:

Storage Systems:

Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system., Apache Hadoop, Big Table, Megastore (textbook 1), Amazon Simple Storage Service(S3) (Text Book 2).

Cloud Security: Cloud security risks, security – atop concern for cloud users, privacy and privacy impact assessment, trust, OS security, Virtual machine security, Security risks.

UNIT-V:

Cloud Application Development:

Amazon Web Services : EC2 – instances, connecting clients, security rules, launching, usage of S3 in Java, Installing Simple Notification Service on Ubuntu 10.04, Installing Hadoop on Eclipse, Cloud based simulation of a Distributed trust algorithm, Cloud service for adaptive data streaming (Text Book 1).

Google: Google App Engine, Google Web Toolkit (Text Book 2).

Micro Soft: Azure Services Platform, Windows live, Exchange Online, Share Point Services, Microsoft Dynamics CRM (Text Book 2)

Text Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, MKE l sevier.
2. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH.

Reference Books:

1. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH.

Web Links:

1. https://aws.amazon.com/getting-started/tutorials/
2. http://nptel.ac.in/courses/106106129/28
3. https://www.coursera.org/learn/cloud-computing/lecture/VOIHP/introduction-to cloud-computing-concepts-part-1
4. https://www.udemy.com/amazon-web-services-for-web-hosting-cloud computing/
5. https://www.lynda.com/Cloud-Computing-training-tutorials/1385-0.html

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INTERNET OF THINGS
(Professional Elective-II)

I Semester **L T P C**
Course Code: 192SE1E06 **3 0 0 3**

Course Objectives:

COB 1: To impart the knowledge about technology of Internet of Things.
COB 2: To make the students develop models and protocols IoT along with the storage mechanisms.

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

CO 1: Explain the idea behind Internet of Things (IoT).
CO 2: Illustrate various business models relevant to IoT.
CO 3: Demonstrate designs for web connectivity.
CO 4: Identify sources of data acquisition related to IoT, integrate to enterprise systems.
CO 5: Illustrate IoT with Cloud technologies.

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	-	-	3	-	-
CO2 (K2)	2	1	-	-	-	2	-	-	3	-	-
CO3 (K2)	2	1	-	-	-	2	-	-	3	-	-
CO4 (K3)	3	2	2	-	-	3	-	-	-	-	-
CO5 (K2)	2	1	-	-	-	2	-	-	3	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K2)
CO1 (K2)	2	2	3
CO2 (K2)	2	2	3
CO3 (K2)	2	2	3
CO4 (K3)	3	3	-
CO5 (K2)	2	2	3

UNIT-I:
The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples OF IoTs, Design Principles For Connected Devices. Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

UNIT-II:
Business Models for Business Processes in the Internet of Things, IoT/M2M systems LAYERS AND designs standard izations, Modified OSI Stack for the IoT/M2M Systems, ETSIM2M domains and High-level capabilities, Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability.

UNIT-III:
Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

UNIT-IV:
Coding and Testing:
Data Acquiring, Organizing and Analytics in IoT/M2M, Applications/Services/Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

UNIT-V:
Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.

Text Books:
1. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education.
2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press,2015.

Reference Books:
1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley.
2. Getting Started with the Internet of Things Cuno Pfister, Oreilly.

Web Links:
1. https://onlinecourses.nptel.ac.in/noc18_cs46/preview
2. https://swayam.gov.in/courses/public?keyword=Introduction%20to%20interne t%20of%20things
3. https://swayam.gov.in/courses/public?keyword=Design%20for%20internet%2 0of%20things
4. https://www.coursera.org/specializations/iot
5. https://www.coursera.org/learn/iot

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RESEARCH METHODOLOGY AND IPR

I Semester	**L**	**T**	**P**	**C**
Course Code: 192HS1T01	**2**	**0**	**0**	**2**

Course Objectives:

COB 1: To demonstrate the identification of the research problems.
COB 2: To make the awareness on the literature studies, plagiarism and ethics.
COB 3: To train the knowledge on technical writing.
COB 4: To analyze the nature of intellectual property rights and new developments
COB 5: To facilitate the need of the patent rights.

Course Outcomes:
At the end of this course the student will be able to:

CO 1: Understand research problem formulation.
CO 2: Analyze research related information.
CO 3: Demonstrate research ethics.
CO 4: Explain the today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CO 5: Discuss that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO 6: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

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 (K3)	3	2	-	-	-	-	-	-	-	-	-
CO2 (K3)	3	2	-	-	-	-	-	-	-	-	-
CO3 (K2)	2	1	-	-	-	2	-	2	-	-	-
CO4 (K2)	-	-	-	-	-	2	3		-	-	-
CO5 (K3)	-	-	-	-	-	-	-	3	-	-	-
CO6 (K3)	-	-	-	-	-	-	-	3	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO / PSO	PSO 1 (K4)	PSO 2 (K4)
CO1 (K3)	-	-
CO2 (K3)	3	-
CO3 (K2)	2	3
CO4 (K2)	2	2
CO5 (K3)	3	3
CO6 (K3)	3	-

UNIT-I:
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT-II:
Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT-III:
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT-IV:
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT-V:
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text Books:
1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students".
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction".
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners".

Reference Books:
1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd,2007.
2. Mayall, "Industrial Design", McGraw Hill, 1992.
3. Niebel, "Product Design", McGraw Hill, 1974.
4. Asimov, "Introduction to Design", Prentice Hall, 1962.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
6. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

Web Links:
1. https://www.wipo.int › documents › ip_innovation_development_fulltext
2. https://www.wipo.int › patent-law › developments › research
3. https://www.cencenelec.eu › research › innovation › IPR › Pages

ADVANCED DATA STRUCTURES LAB

I Semester	**L**	**T**	**P**	**C**
Course Code: 192SE1L01	**0**	**0**	**4**	**2**

Course Objectives:

COB 1: To illustrate oops concepts for a specific problem.
COB 2: To implement various advanced data structures concepts like arrays, stacks, queues, linked lists, graphs and trees.

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

CO 1: Identify classes, objects, members of a class and relationships among them needed for a specific problem.
CO 2: Examine algorithms performance using Prior analysis and asymptotic notations.
CO 3: Organize to solve the complex problems using advanced data structures (like arrays, stacks, queues, linked lists, graphs and trees.
CO 4: Apply functions of Dictionary.

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 (K3)	3	2	1	1	3	-	3	-	-	-	-
CO2 (K4)	3	2	1	1	3	-	-	-	-	-	-
CO3 (K3)	3	2	1	1	3	-	3	-	-	-	-
CO4 (K3)	3	2	1	1	3	-	3	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K2)
CO1 (K3)	3	3	2
CO2 (K4)	3	3	1
CO3 (K3)	3	3	2
CO4 (K3)	3	3	2

List of Experiments

Experiment 1:
Implement Multi stacks.

Experiment 2:
Implement Double Ended Queue (Dequeues) & Circular Queues

Experiment 3:
Implement various Recursive operations on Binary Search Tree

Experiment 4:
Implement various Non-Recursive operations on Binary Search Tree

Experiment 5:
Implement BFS for a Graph

Experiment 6:
Implement DFS for a Graph.

Experiment 7:
Implement Merge & Heap Sort of given elements.

Experiment 8:
Implement Quick Sort of given elements.

Experiment 9:
Implement various operations on AVL trees.

Experiment 10:
Implement B Tree operations.

Experiment 11:
Implementation of Binary trees Traversals.

Experiment 12:
Implement Krushkal's algorithm to generate a min-cost spanning tree.

Experiment 13:
Implement Prim's algorithm to generate a min-cost spanning tree.

Experiment 14:
Implement functions of Dictionary using Hashing.

Web Links:

1. https://ocw.mit.edu/courses/...and.../6-006-introduction-to-algorithms-spring 2008/
2. https://www.coursera.org/specializations/data-structures-algorithm
3. https://in.udacity.com/course/intro-to-algorithms--cs215
4. https://www.alljntuworld.in/jntu-lab-manuals/

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SOFTWARE ENGINEERING LAB – I

I Semester **L T P C**
Course Code: 192SE1L02 **0 0 4 2**

Course Objectives:

COB 1: To make the students demonstrate the software engineering methodologies involved in the phases for project development.
COB 2: To teach the basic concepts of open source tools used for implementing software engineering methods.
COB 3: To enable the concepts develop product-start-ups implementing software engineering methods.

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

CO 1: Make use of UML to develop the software project.
CO 2: Select Structural Modeling.
CO 3: Utilize Behavioural and Architectural Modelling.
CO 4: Examine estimation about schedule and cost for project development.
CO 5: Select project development tool.

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 (K3)	3	2	1	1	3	3	2	-	-	-	-
CO2 (K3)	3	2	1	1	3	3	2	-	-	-	-
CO3 (K3)	3	2	1	1	3	3	2	-	-	-	-
CO4 (K4)	3	3	2	2	3	3	-	-	-	-	-
CO5 (K3)	3	2	1	1	3	3	2	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K2)
CO1 (K3)	3	3	2
CO2 (K3)	3	3	2
CO3 (K3)	3	3	2
CO4 (K4)	3	3	1
CO5 (K3)	3	3	2

Open source Tools: Star UML / UML Graph /Top cased:

Prepare the following documents and develop the software project startup, prototype model, using software engineering methodology for at least two real time scenarios or for the sample experiments.

1. Problem Analysis and Project Planning -Thorough study of the problem – Identify Project scope, Objectives and Infrastructure.
2. Software Requirement Analysis – Describe the individual Phases/modules of the project and Identify deliverables. Identify functional and non-functional requirements.
3. Data Modeling – Use work products – data dictionary.
4. Software Designing - Develop use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class

diagrams.

5. Prototype model – Develop the prototype of the product.

The SRS and prototype model should be submitted for end semester examination. List of Sample Experiments:

1. Student Enrolment System.

A University has contracted you to develop their new student records system. The normal tasks that the system performs are as follows:

- **Enroll a student at the university:**

A student provides his or her personal details (name, address, sex, date of birth), along with the code of the course (e.g. Bachelor of Computer Science) in which he or she wishes to enroll. A student record is created, and a unique student ID number is assigned to the student. The system automatically enrolls the student in any core first-year subjects for the course.

- **Enroll a student in a subject:**

A student provides his or her student ID number and the subject code of the subject in which he or she wish to enroll. The system checks that the subject requested by the student is allowed for the course in which the student is enrolled. If not, the enrolment request is rejected. The system checks what subjects (if any) are specified as prerequisites for the subject in which the student wishes to enroll. If the student has passed all the prerequisite subjects, he or she is enrolled in the desired subject. Otherwise, the enrolment request is rejected.

- **Record a mark for a student:**

A staff member accesses the system by giving a subject code and a password for that subject. If the password is correct, the system displays the list of students enrolled in the subject to the staff member. The staff member can then specify a mark for any student on the list.

- **Create a new subject:**

An administrator accesses the system using a password. The administrator then chooses a subject code for the new subject. The system checks that this code is not already in use in the system, and if not, creates a new subject record. The administrator then gives the subject name, the course to which it belongs, the year of the course in which it may first be taken, a flag indicating whether or not it is a core subject and the codes of any prerequisite subjects.

- **Print a transcript of a student's results:**

An administrator accesses the system using a password. The administrator then gives the student ID number of the student for whom the transcript is to be generated. The system contacts the finance system to check whether or not the student has paid all fees. If fees have been paid, the system creates a transcript showing all the subjects in which the student has been enrolled in each year, and the mark for that subject. The header of the transcript shows the student's personal details and the course in which he or she is enrolled.

- **Assign a staff member to a subject:**

An administrator accesses the system using a password. The administrator then gives the subject code for the subject to which the staff member is to be assigned and the staff ID number of the staff member.

2. Online Bookshop.

A major book retailer is planning to develop a computer system to handle their new online bookshop: Booky.com. You have been chosen to do the analysis and design. The following requirements have been identified:

- Customers can search for books on the Booky.com website, either by author name, or words in the title. A list of all matching books is returned to the customer. A customer does not need to be logged-in in order to search. The system records all the customers of the Booky.com who have ever logged in. A customer may be an individual customer or a business customer. Each customer has a username and password. Business customers may have several usernames and passwords, corresponding to different divisions within the business.

- **When a customer has selected a book to buy at the Booky.com website.**

The system prompts for the customer's username and password. The customer enters these details. The system verifies the customer's identity and retrieves the customer's name and address, then prompts for credit card details. The customer enters these details. The system checks the credit card details. The system shows the customer the book and delivery price. The customer confirms the transaction. The system records all books available at Booky.com. For each book, the author, title and ISBN number are recorded. The number of each book in stock is also stored, along with the number on order by customers and the number on order from publishers. Books may be temporarily unavailable. All books are stored in the Booky.com warehouse. The warehouse can be contacted via a secure internet connection.

- For each customer, a permanent record of books bought by that customer is maintained. Likewise, for each book, a record of customers who have bought that book is kept.
- A customer order consists of one or more order lines, each corresponding to a particular book. A customer may choose to defer the shipment of an order until all the order lines have been filled.
- When the warehouse fills all or part of customer order, an email is sent to the customer informing them of what has been shipped.
- If a book ordered by a customer turns out to be unavailable, the corresponding order line is flagged and an email is sent to the customer informing them of the problem. At this stage the customer can cancel this order line.
- When a book corresponding to a previously-unavailable order line becomes available, an email is sent to the customer and a copy of the book is held for seven days, after which it is returned to normal stock if the customer has not confirmed the order.
- The shop keeps track of which publishers produce particular book titles. Some books may be available from more than one publisher.
- Although Booky.com will initially sell only books, it is envisaged that in future it will offer further products, such as CDs. The list of possible future

products has not yet been finalized.

3. Course Management System

A course management system(CMS) is a collection of software tools providing an online environment for course interactions. A CMS typically includes a variety of online tools and environments, such as:

- An area for faculty posting of class materials such as course syllabus and handouts
- An area for student posting of papers and other assignments.
- A grade book where faculty can record grades and each student can view his or her grades.
- An integrated email tool allowing participants to send announcement email messages to the entire class or to a subset of the entire class.
- A chat tool allowing synchronous communication among class participants
- A threaded discussion board allowing asynchronous communication among participants.

In addition, a CMS is typically integrated with other databases in the university so that students enrolled in a particular course are automatically registered in the CMS as participants in that course.

The Course Management System (CMS) is a web application for department personnel, Academic Senate, and Registrar staff to view, enter, and manage course information formerly submitted via paper.

Departments can use CMS to create new course proposals, submit changes for existing courses, and track the progress of proposals as they move through the stages of online approval.

4. Easy Leave

This project is aimed at developing a web based Leave Management Tool, which is of importance to either an organization or a college. he Easy Leave s an Intranet based application that can be accessed throughout the organization or a specified group/Dept. This system can be used to automate the workflow of leave applications and their approvals. The periodic crediting of leave is also automated. There are features like notifications, cancellation of leave, automatic approval of leave, report generators etc in this Tool.

Functional components of the project:

There are registered people in the system. Some are approvers. An approver can also be a requestor. In an organization, the hierarchy could be Engineers/Managers/Business Managers/Managing Director etc. In a college, it could be Lecturer/Professor/Head of the Department/Dean/Principal etc.

Following is a list of functionalities of the system:

1. A person should be able to
    - login to the system through the first page of the application.
    - change the password after logging into the system.
    - see his/her eligibility details (like how many days of leave he/she is eligible for etc).
    - query the leave balance.
    - see his/her leave history since the time he/she joined the company/college.
    - apply for leave, specifying the form and to dates, reason for taking leave, address for communication while on leave and his/her superior's email id.

- see his/her current leave applications and the leave applications that are submitted to him/her for approval or cancellation.
- approve/reject the leave applications that are submitted to him/her.
- withdraw his/her leave application (which has not been approved yet).
- Cancel his/her leave (which has been already approved). This will need to be approved by his/her Superior.
- get help about the leave system on how to use the different features of the system.

2. As soon as a leave application /cancellation request/withdrawal/approval/rejection/password-change is made by the person, an automatic email should be sent to the person and his superior giving details about the action.
3. The number of days of leave (as per the assumed leave policy) should be automatically credited to everybody and a notification regarding the same be sent to them automatically

An automatic leave-approval facility for leave applications which are older than 2 weeks should be there. Notification about the automatic leave approval should be sent to the person as well as his superior

5. E-Bidding

Auctions are among the latest economic institutions in place. They have been used since antiquity to sell a wide variety of goods, and their basic form has remained unchanged. In this dissertation, we explore the efficiency of common auctions when values are interdependent- the value to a particular bidder may depend on information available only to others-and asymmetric. In this setting, it is well known that sealed-bid auctions do not achieve efficient allocations in general since they do not allow the information held by different bidders to be shared.

Typically, in an auction, say of the kind used to sell art, the auctioneer sets a relatively low initial price. This price is then increased until only one bidder is willing to buy the object, and the exact manner in which this is done varies. In my model a bidder who drops out at some price can "reenter" at a higher price. With the invention of E-commerce technologies over the Internet the opportunity to bid from the comfort of one's own home has seen a change like never seen before. Within the span of a few short years, what may have began as an experimental idea has grown to an immensely popular hobby, and in some cases, a means of livelihood, the Auction Patrol gathers tremendous response every day, all day. With the point and click of the mouse, one may bid on an item they may need or just want, and in moments they find that either they are the top bidder or someone else wants it more, and you're outbid! The excitement of an auction all from the comfort of home is a completely different experience.

Society cannot seem to escape the criminal element in the physical world, and so it is the same with Auction Patrols. This is one area where in a question can be raised as to how safe Auction Patrols.

Proposed system

1. To generate the quick reports
2. To make accuracy and efficient calculations
3. To provide proper information briefly
4. To provide data security
5. To provide huge maintenance of records

6. Flexibility of transactions can be completed in time

6. Electronic Cash counter

This project is mainly developed for the Account Division of a Banking sector to provide better interface of the entire banking transactions. This system is aimed to give a better outlook to the user interfaces and to implement all the banking transactions like:

- Supply of Account Information
- New Account Creations
- Deposits
- Withdraws
- Cheque book issues
- Stop payments
- Transfer of accounts
- Report Generations.

Proposed System: The development of the new system contains the following activities, which try to automate the entire process keeping in view of the database integration approach.

- User friendliness is provided in the application with various controls.
- The system makes the overall project management much easier and flexible.
- Readily upload the latest updates, allows user to download the alerts by clicking the URL.
- There is no risk of data mismanagement at any level while the project development is under process.

It provides high level of security with different level of authentication

7. Enterprise Security Services

Verification and Validation is a part of S/W Quality Assurance. Verification refers to the set of activities that ensure correctly implements a specific function. Validation refers to a different set of activities that ensure that the software that has been built is traceable to customer requirements.

Verification:" Are we building the product right" Validation: "Are we building the right product"

The project entitled Independent Project Metrics is an effort, to develop a tool to manage the Verification and Validation process.

The specific purpose of the Independent Verification and Validation Process o f Project Metrics Tool is to bring out the various Verification and validation tasks to be performed. The scope of the Project Metrics is to cover the developed for system.

The goals of the V&V effort is to ensure that the software and the documents are developed are of high quality as expected from any mission critical software. This project generates the plan for Verification and validation process. This project maintain the document names, source code module names, version number, released date, receiving date size of document and source code modules of receiving projects for Verification and validation.

Using this application we assign the tasks/activities to different persons and also calculate the expected efforts and actual efforts. The V&V co-coordinator does this work.

Proposed System:

The general description gives an "executive overview" and is very client- oriented. It expounds on the functional and data requirements of the application. It also lists the limitations, assumptions and dependencies of the application. It also touches on the performance and quality requirements of the application and provides a solid definition of the interface

The computerization of this system would avoid the wrong interpretation and bad calculation of data .The system help the user to see any documents, source code, tasks, activities, team information with details at the click of a button. The record data is maintained and backed up such a way that data is not loss. The speed of the system could also increased.

8. ERP

ERP is a powerful human resource tool for maintaining employee and company information. More than a data storage program, ERP helps you manage your employees. ERP offers a wide variety of reports that give you
exactly the information you need. View payroll information by department, or find everyone who is receiving company.

Module Description:

1. Payroll
2. Employee
3. Employee pay slip
4. Selection process
5. Reports
6. Mailing System
7. Training
8. Add Company information

Proposed System

The proposed system is designed to eliminate all the drawbacks of the existing system. The system is part of a large HRMS Application and shall be responsible for maintaining information about employees,

- positions,
- company benefits,
- departments,
- new recruit checklists,
- employee achievements,
- warnings,
- evaluation reports,
- education &training,
- administration,
- Work changes and several ad hoc reports. The major advantage of the proposed system is,
- It's online, so that information is available anytime.
- High integrity and security.
- Ability to incorporate newly available data.

- It is user friendly
- Speed and accuracy is increased
- Fully automated.
- Security is associated with user authentication
- Duplication of information is curbed

9. Examination Branch System

The project "Examination Branch System" is developed to reduce the overhead involved in the process of maintains the data and the transaction in the Examination branch. Examination branch is an intranet application for an organization. It is software which is used to perform all the examination activities like adding employees, search employees, delete employees and assign examination duties etc.
The basic framework of the project is developed in .NET. Making use of this application the administrator can perform their activities through it.

Proposed System:

- Now we can extend our project to assign duties to faculty. We can implement edit, update operations now. We can develop our project as a user friendly type

10. Exam Experts

The system would be providing a number of services, automating the processes that are being done manually. The services include communication services such as mailing facility, chat service, electronic file transfer etc and office automation packages such as leave letter processing, admission management, teaching evaluation, counselling automation etc.
The aim of the project is to design a comprehensive web enabled application for management of the Examination Process. Examination system is categorized into various sections. Among those sections, this system concentrates on the work being done in section (E-X). The section (E-X) deals with the confidential work, i.e., Coding-Decoding of answer scripts, Processing of results, Computerization of certificates etc. This is an automated section and it plays a pivotal role in the Examination Process starting from the Application Processing to the final announcement of results This project is aimed to solve many of the problems that are in the existing system and also provide a hassle free system that is efficient and easy to use. This project concentrates mainly on Application Processing, Marks Processing and Results Processing with an easy to use interface. The system also provides a means to generate and print various types of reports.
This project can include an

Application Processing System:

This phase involves the storing of the application information and generating the required reports.

- Entry of Application forms according to center, course order and batch
- Generating Application Id for further transactions
- Capturing of photographs of students for hall ticket processing
- Reports involving the information about students who are appearing for supplementary exams
- Generating nominal roles

Reports describing the college, course, subjects and the students appearing

Web Links:

1. http://www.aptest.com/resources.html
2. http://www.softwaretestinghelp.com/test-case-template-examples/
3. https://www.guru99.com/automation-testing.html
4. https://www.guru99.com/selenium-tutorial.htm
5. https://www.tutorialspoint.com/jenkins/

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SERVICE ORIENTED ARCHITECTURES

II Semester	**L**	**T**	**P**	**C**
Course Code: 192SE2T03	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To enable the students to learn about service oriented architectures.
COB 2: To discuss various SOA strategies and modelling techniques
COB 3: To make the students to learn the concept of SOA designing process.
COB 4: To develop the students to implement SOA in different areas.
COB 5: To describe the need for managing SOA environment.
COB 6: To make the students to learn service oriented analysis techniques.

Course Outcomes:

At the end of the course, student will be able to:

CO 1: Relate web services with service oriented architecture.
CO 2: Utilize SOA in development cycle of Web Services.
CO 3: Determine different tasks based on business process model.
CO 4: Examine the operational management challenges in managing SOA environment
CO 5: Build SOA-based applications for intra-enterprise and inter-enterprise Applications.

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 (K3)	1	2	1	-	-	-	-	-	-	-	-
CO3 (K5)	-	3	3	-	-	-	-	-	-	-	-
CO4 (K4)	-	3	3	-	3	-	-	-	-	-	-
CO5 (K3)	1	2	3	3	3	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K3)
CO1 (K2)	2	-	-
CO2 (K3)	3	-	3
CO3 (K5)	1	-	-
CO4 (K4)	2	-	-
CO5 (K3)	3	3	3

UNIT–I:

SOA Fundamentals:

Defining SOA, Business Value of SOA, Evolution of SOA, SOA characteristics, concept of a service in SOA, misperceptions about SOA, Basic SOA architecture, infrastructure services, Enterprise Service Bus (ESB), SOA Enterprise Software models, IBM On Demand operating environment.

UNIT-II:

SOA Planning and Analysis:

Stages of the SOA lifecycle, SOA Delivery Strategies, service-oriented analysis, Capture and assess business and IT issues and drivers, determining non-functional requirements (e.g., technical constraints, business constraints, runtime qualities, no runtime qualities), business centric SOA and its benefits, Service modeling, Basic modeling building blocks, service models for legacy application integration and enterprise integration, Enterprise solution assets(ESA).

UNIT–III:

SOA Design and implementation:

Service-oriented design process, design activities, determine services and tasks based on business process model, choosing appropriate standards, articulate architecture,

UNIT-IV:

Mapping business processes to technology:

Designing service integration environment (e.g., ESB, registry), Tools available for appropriate designing, implementing SOA, security implementation, implementation of integration patterns, services enablement, quality assurance

UNIT-V:

Managing SOA Environment:

Distributing service management and monitoring concepts, operational management challenges, Service-level agreement considerations, SOA governance (SLA, roles and responsibilities, policies, critical success factors, and metrics), QoS compliance in SOA governance, role of ESB in SOA governance, impact of changes to services in the SOA lifecycle.

Text Books:

1. Service-Oriented Architecture: Concepts, Technology, and Design, Thomas Erl, Prentice Hall Publication, 1st Edition, 2005.
2. Service-Oriented Architecture Compass: Business Value, Planning, and Enterprise Roadmap, Norbert Bieberstein, Sanjay Bose, Marc Fiammante, Keith Jones, Rawn Shah, IBM Press Publication, 1st Edition, 2005.

Reference Books:

1. Service-Oriented Architecture: A Field Guide to Integrating XML and Web Services, Thomas Erl, Prentice Hall Publication, 1st Edition, 2004.
2. Enterprise Service Bus, Dave Chappell, O'Reilly Publications, 1st Edition, 2004.

Web Links:

1. https://en.wikipedia.org/wiki/Resource-oriented_architecture
2. https://www-01.ibm.com/software/info/ondemand/innovation.html
3. https://www.pluralsight.com/courses/soa-real-world-design-implementation\
4. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.521.6727&rep=rep1&type=pdf

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

II Semester	**L**	**T**	**P**	**C**
Course Code: 192SE2T04	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To help students in acquiring the relevance of statements, inferences and predicates in computer science.
COB 2: To impart the knowledge on operations associated with set theory and relations.
COB 3: To enable the students to know the basic concepts of Binomial theorems, permutations and combinations.
COB 4: To inculcate the students familiar with generating functions and recurrence relation
COB 5: To provide knowledge on predicate logic and Graph Theory

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

CO 1: Apply mathematical logic to solve computational problems.
CO 2: Distinguish between statement logic and predicate logic.
CO 3: Make use of the concepts related to set theory and algebraic structure for solving mathematical problems.
CO 4: Analyze the mathematical concepts based on elementary combinatorics.
CO 5: Solve recurrence relation by substitution and generating functions.
CO 6: Apply Graph Theory to solve computational problems.

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)	1	2	-	3	-	2	-	-	3	-	-
CO2(K2)	-	-	-	2	-	1	-	-	3	-	-
CO3(K3)	1	2	1	3	-	-	-	-	3	-	-
CO4(K4)	2	3	2	-	3	-	-	-	-	-	-
CO5(K3)	1	2	-	-	-	-	-	-	-	-	-
CO6(K3)	1	2	1	3	3	-	-	3	3	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K3)
CO1(K3)	2	2	2
CO2(K2)	1	1	1
CO3(K3)	2	2	-
CO4(K4)	3	3	3
CO5(K3)	-	2	2
CO6(K3)	2	2	2

UNIT–I:

Mathematical Logic:

Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof. Predicate Calculus: Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

UNIT-II:

Set Theory:

Introduction, Operations on Binary Sets, Principle of Inclusion and Exclusion, Relations: Properties of Binary Relations, Relation Matrix and Digraph, Operations on Relations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering Relations, Hasse Diagrams, Functions: Bijective Functions, Composition of Functions, Inverse Functions, Permutation Functions, Recursive Functions, Lattice and its Properties

UNIT–III:

Algebraic Structures and Graph Theory:

Algebraic Structures: Algebraic Systems, Examples, General Properties, Semi Groups and Monoids, Homomorphism of Semi Groups and Monoids, Group, Subgroup, Abelian Group, Homomorphism, Isomorphism. Graph Theory: Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs).

UNIT-IV:

Combinatorics:

Basic of Counting, Permutations, Permutations with Repetitions, Circular Permutations, Restricted Permutations, Combinations, Restricted Combinations, Generating Functions of Permutations and Combinations, Binomial and Multinomial Coefficients, Binomial and Multinomial Theorems, The Principles of Inclusion–Exclusion, Pigeonhole Principle and its Application.

UNIT-V:

Recurrence Relations:

Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations.

Text Books:

1. Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.
2. Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.
3. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill.

Reference Books:

1. Discrete Mathematics for Computer Scientists and Mathematicians, J. L. Mott, A. Kandel, T. P. Baker, 2nd Edition, Prentice Hall of India.
2. Discrete Mathematical Structures, Bern and Kolman, Robert C. Busby, Sharon Cutler Ross, PHI.
3. Discrete Mathematics, S. K. Chakra borthy and B.K. Sarkar, Oxford,

Web Links:

1. https://www.tutorialspoint.com/discrete_mathematics/discrete_mathematics_p roposi tional_logic.htm
2. http://www.inf.ed.ac.uk/teaching/courses/dmmr/slides/13-14/Ch2.pdf
3. https://www.coursera.org/learn/discrete-mathematics
4. www.math.hkbu.edu.hk/~zqiao/Math1130_2009/Chap3.pdf
5. https://www.tutorialspoint.com/discrete_mathematics/discrete_mathematics_r ecurre nce_relation.htm
6. http://nptel.ac.in/courses/106106094/

SOFTWARE TESTING METHODOLOGIES
(Professional Elective – III)

II Semester	**L**	**T**	**P**	**C**
Course Code: 192SE2E06	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To teach the basic concepts of software testing.
COB 2: To illustrate the difference between Verification and Validation Activities.
COB 3: To demonstrate various levels of software Testing.
COB 4: To discuss the need of test suite management.
COB 5: To create awareness on various Automation Testing tools.

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

CO 1: Explain the fundamentals of software testing.
CO 2: Compare the SDLC with STLC.
CO 3: Summarize verification and validation activities.
CO 4: Design the test cases using different testing strategies.
CO 5: Outline the importance of static testing.
CO 6: Illustrate various levels of software testing.
CO 7: Discuss on various Automation Testing tools.

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	-	-	-	-	-	-	-	-	-
CO2 (K4)	3	3	-	-	-	-	-	-	-	-	-
CO3 (K2)	2	1	-	-	-	-	-	-	-	-	-
CO4 (K6)	3	3	3	3	3	-	-	-	-	-	-
CO5 (K2)	2	1	-	-	2	-	-	-	-	-	-
CO6 (K2)	2	-	-	-	2	-	-	-	-	-	-
CO7 (K6)	3	3	3	3	3	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K3)
CO1 (K2)	2	-	-
CO2 (K4)	-	-	3
CO3 (K2)	-	2	-
CO4 (K6)	3	3	-
CO5 (K2)	2	2	-
CO6 (K2)	-	-	-
CO7 (K6)	3	3	3

UNIT-I:
Introduction:
Purpose of Testing, Dichotomies, Model for Testing, Consequences of Bugs, Taxonomy of Bugs. Flow graphs and Path testing: Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing.

UNIT-II:

Transaction Flow Testing:

Transaction Flows, Transaction Flow Testing Techniques. Dataflow testing: Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing.

UNIT-III:

Domain Testing:

Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interfaces Testing, Domain and Interface Testing, Domains and Testability. Paths, Path products and Regular expressions: Path Products & Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection.

UNIT-IV:

Logic Based Testing:

Overview, Decision Tables, Path Expressions, KV Charts, and Specifications. State, State Graphs and Transition Testing: State Graphs, Good & Bad State Graphs, State Testing, and Testability Tips. Graph Matrices and Application:-Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm.

UNIT-V:

Software Testing Tools:

Introduction to Testing, Automated Testing, Concepts of Test Automation, 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.

Text Books:

1. Software testing techniques – Boris Beizer, Dreamtech, second edition.
2. Software Testing- Yogesh Singh, Camebridge

Reference Books:

1. The Craft of software testing - Brian Marick, Pearson Education.
2. Software Testing, 3rd edition, P.C. Jorgensen, Aurbach Publications (Dist.by SPD).
3. Software Testing, N. Chauhan, Oxford University Press.
4. Introduction to Software Testing, P.Ammann & J.Offutt, Cambridge Univ. Press..

Web Links:

1. https://en.wikipedia.org/wiki/Resource-oriented_architecture
2. https://www-01.ibm.com/software/info/ondemand/innovation.html
3. https://www.pluralsight.com/courses/soa-real-world-design-implementation\
4. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.521.6727&rep=rep1&type=pdf

AGILE SOSTWARE DEVELOPMENT
(Professional Elective-III)

II Semester	**L**	**T**	**P**	**C**
Course Code: 192SE2E07	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To discuss about origins and motivations of the Agile Manifesto.
COB 2: To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
COB 3: To interpret the various Agile models with software developments
COB 4: To Provide practical knowledge of how to develop Sprint and extract the User Stories
COB 5: To discuss the importance of Product Backlog and Estimations in the Scrum Project
COB 6: To Provide practical knowledge of how to manage a project using Scrum framework.

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

CO 1: Compare the Agile Model with Traditional Models.
CO 2: Summarize the Agile Manifesto.
CO 3: Demonstrate the various Agile Software Development Process Models.
CO 4: Model the Sprint framework in Agile environment.
CO 5: Create User Stories for software requirements in Agile Software Development.
CO 6: Identify the role of Product Backlog and Estimations for each Sprint.
CO 7: Organize the plans for each Sprint in the Scrum Framework.

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	-	-	-	-	-	-
CO2 (K2)	2	1	-	-	2	-	-	-	-	-	-
CO3 (K2)	2	1	-	-	2	-	-	-	-	-	-
CO4 (K3)	3	2	1	1	3	-	-	-	-	-	-
CO5 (K6)	3	3	3	3	3	-	-	-	-	-	-
CO6 (K3)	3	2	1	1	3	-	-	-	-	-	-
CO7 (K3)	3	2	1	1	3	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO / PSO	PSO 1 (K3)	PSO 2 (K3)	PSO 3 (K3)
CO1 (K2)	-	-	3
CO2 (K2)	-	-	-
CO3 (K2)	-	-	3
CO4 (K3)	-	3	-
CO5 (K6)	-	3	-
CO6 (K3)	3	3	3
CO7 (K3)	3	3	-

UNIT-I:

Introduction:

Agile Methods, Agile Manifesto, and Agile Modeling Introduction, What Is Agile, The Agile Manifesto, Agile Methods, XP: Extreme Programming, DSDM, SCRUM, Feature-Driven Development, Modeling Misconceptions, Agile Modeling, Tools of Misconceptions, Updating Agile Models

UNIT-II:

Extreme Programming:

Introduction, Core XP Values, The Twelve XP Practices, About Extreme Programming, Planning XP Projects, Test First Coding, Making Pair Programming Work

UNIT-III:

Agile Modeling and XP:

Introduction, The Fit, Common Practices, Modeling Specific Practices, XP Objections to Agile Modeling, Agile Modeling and Planning XP Projects, XP Implementation Phase

UNIT-IV:

Feature-Driven Development:

Introduction, Incremental Software Development, Regaining Control: The Motivation behind FDD, Planning an Iterative Project, Architecture Centric, FDD and XP,

UNIT-V:

Agile Methods with RUP and PRINCE2 and Tools and Obstacles:

Agile Modeling and RUP, FDD and RUP, Agile Methods and Prince2, Tools to Help with Agile Development, Eclipse: An Agile IDE, Obstacles to Agile Software Development, Management Intransigence, The Failed Project Syndrome, Contractual Difficulties, Familiarity with Agility

Text Books:

1. Agile software construction,1/e,John hunt, springer, 2005
2. Agile and Iterative Development: a manager's guide, Addison-Wesley Craig Larman, [Pearson Education] - 2004.

Reference Books:

1. The Art of Agile Development, Pearson, Robert C. Martin, Juli, James Shore, Chromatic, 2013, O'Reilly Media.
2. Agile Testing, Elisabeth Hendrickson, Quality Tree Software Inc 2008.

Web Links:

1. https://www.edx.org/course/agile-software-development
2. https://www.class-central.com/course/coursera-agile-software-development-9513
3. https://www.cprime.com/resources/what-is-agile-what-is-scrum/
4. https://www.atlassian.com/agile/kanban
5. https://file.scirp.org/pdf/JCC_2017033115471602.pdf

ERP & SUPPLY CHAIN MANAGEMENT
(Professional Elective-III)

II Semester	**L**	**T**	**P**	**C**
Course Code: 192SE2E08	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To enable the students to interpret various kinds of inventory management strategies.
COB 2: To demonstrate various kinds of enterprise level resource planning models.
COB 3: To impart the knowledge of supply driven market strategies
COB 4: To demonstrate SCM startegies.
COB 5: To elucidate the demand driven market strategies.

Course Outcomes:
At the end of this course the student will be able to:

CO 1: Identify various kinds of inventory management strategies in ERP.
CO 2: Develop various kinds of enterprise level resource planning models.
CO 3: Apply supply driven market strategies in distribution management.
CO 4: Apply demand driven market strategies in Supply chain management.
CO 5: Interpret Mathematical foundations of distributed management.

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)	1	-	-	-	-	-	-	-	-	-	-
CO2 (K3)	1	-	-	-	-	2	3	-	-	-	-
CO3 (K3)	-	-	-	-	-	2	3	-	-	-	-
CO4 (K3)	-	-	-	-		2	3	-	-	-	-
CO5 (K2)	1	-	-	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K3)
CO1 (K3)	3	-	-
CO2 (K3)	3	-	2
CO3 (K3)	1	3	-
CO4 (K3)	-	-	-
CO5 (K2)	-	-	2

UNIT-I:
Introduction to ERP:
Overview – Benefits of ERP, ERP and Related Technologies, Business Process Reengineering, Data Warehousing, Data Mining – On–line Analytical Processing, Supply Chain Management.
ERP Implementation: Implementation Life Cycle, Implementation Methodology, Hidden Costs, Organizing Implementation, Vendors, Consultants and Users, Contracts, Project Management and Monitoring.

UNIT-II:

Business Modules:

Business Modules in an ERP Package , Finance, Manufacturing, Human Resource, Plant Maintenance, Materials Management, Quality Management, Sales and Distribution.

Fundamentals of Supply Chain Management: Supply chain networks, Integrated supply chain planning, Decision phases in s supply chain, process view of a supply chain, supply chain flows, Overview of supply chain models and modeling systems, Supply chain planning: Strategic, operational and tactical, Understanding supply chain through process mapping and process flow chart.

UNIT-III:

SCM Strategies, Performance:

Supply chain strategies, achieving strategic fit, value chain, Supply chain drivers and obstacles, Strategic Alliances and Outsourcing, purchasing aspects of supply chain, Supply chain performance measurement: The balanced score card approach, Performance Metrics. Planning demand and supply: Demand forecasting in supply chain, Aggregate planning in supply chain, Predictable variability.

UNIT-IV:

Planning and Managing Inventories:

Introduction to Supply Chain Inventory Management. Inventory theory models: Economic Order Quantity Models, Reorder Point Models and Multi echelon Inventory Systems, Relevant deterministic and stochastic inventory models and Vendor managed inventory models.

Distribution Management: Role of transportation in a supply chain - direct shipment, warehousing, cross-docking; push vs. pull systems; transportation decisions (mode selection, fleet size), market channel structure, vehicle routing problem. Facilities decisions in a supply chain. Mathematical foundations of distribution management, Supply chain facility layout and capacity planning.

UNIT-V:

Strategic Cost Management in Supply Chain:

The financial impacts, Volume leveraging and cross docking, global logistics and material positioning, global supplier development, target pricing, cost management enablers, Measuring service levels in supply chains, Customer Satisfaction/Value/Profitability/Differential Advantage.

Text Books:

1. ERP Demystified, Alexis Leon, TMH, 2nd Edition, 2007.
2. Supply Chain Management: Strategy, Planning, Operation, Sunil Chopra, Peter Meindel, PEA, 1st Edition 2002.

Reference Books:

1. Enterprise Resource Planning: Fundamentals of Design and Implementation, K. Ganesh, Sanjay Mohapatra, S.P. Anbuudayasankar, P. Sivakumar, Springer, 1st Edition.
2. Enterprise Resource Planning 3rd Edition, Bret Wagner, Ellen Monk, TMH, 3rd Edition.

Web Links:

1. https://www.slideshare.net/WelingkarDLP/introduction2-erp
2. http://www.personal.psu.edu/axk41/ERP-intro.pdf
3. https://www.slideshare.net/rajnikantxidas/erp-module
4. http://www2.unb.ca/~ddu/4690/Lecture_notes/Lec2.pdf

SECURE SOFTWARE ENGINEERING
(Professional Elective -IV)

II Semester	**L**	**T**	**P**	**C**
Course Code: 192SE2E09	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To introduce issues that must be considered in the specification and design of secure software.
COB 2: To elucidate security risk management and the derivation of security requirements from a risk analysis.
COB 3: To demonstrate good design practice for secure systems development.
COB 4: To explain the notion of system survivability and to introduce a method of survivability analysis.
COB 5: To impart knowledge on software security and how to develop more secure software systems.

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

CO 1: Illustrate basic software security concepts and their impacts.
CO 2: Interpret the important aspects of secure software Engineering.
CO 3: Apply best-practices for the development of secure software.
CO 4: Make use of security in each phase of secure software development lifecycle.
CO 5: Apply techniques and tools to avoid intervention of security vulnerabilities.

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)	-	1	-	-	-	-	-	-	-	-	-
CO2 (K2)	-	1	-	2	-	-	-	-	-	-	-
CO3 (K3)	1	3	3	-	3	-	-	-	-	-	-
CO4 (K3)	1	-	3	-	3	-	-	-	-	-	-
CO5 (K3)	1	2	3	3	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K3)
CO1 (K2)	2	-	-
CO2 (K2)	-	-	-
CO3 (K3)	3	3	3
CO4 (K3)	3	-	-
CO5 (K3)	3	-	3

UNIT-I:

Why Is Security a Software Issue:
Introduction, The Problem, Software Assurance and Software Security, Threats to Software Security, Sources of Software Insecurity, The Benefits of Detecting Software Security Defects Early, Managing Secure Software Development.

What Makes Software Secure: Introduction, Defining Properties of Secure Software, How to Influence the Security Properties of Software, How to Assert and Specify Desired Security Properties.

UNIT-II:

Requirements Engineering for Secure Software:

Introduction, Misuse and Abuse Cases, The SQUARE Process Model, SQUARE Sample Outputs, Requirements Elicitation and Requirements Prioritization.

UNIT-III:

Secure Software Architecture and Design:

Introduction, Software Security Practices for Architecture and Design: Architectural Risk Analysis, Software Security Knowledge for Architecture and Design: Security Principles, Security Guidelines, and Attack Patterns.

Considerations for Secure Coding and Testing: Introduction, Code Analysis, Coding Practices, Software Security Testing, Security Testing Considerations throughout the SDLC.

UNIT-IV:

Security and Complexity: System Assembly Challenges:

Introduction, Security Failures, Functional and Attacker Perspectives for Security Analysis: Two Examples, System Complexity Drivers and Security, Deep Technical Problem Complexity.

UNIT-V:

Governance, and Managing for More Secure Software:

Introduction, Governance and Security, Adopting an Enterprise Software Security Framework, How Much Security Is Enough?, Security and Project Management, Maturity of Practice.

Text Books:

1. Software Security Engineering: A Guide for Project Managers, Julia H. Allen, Sean Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, Addison-Wesley Professional, 1st Edition.
2. SDL: The Security Development Lifecycle, Howard, M and Lipner, Microsoft Press, 1st Edition, 2006.

Reference Books:

1. Building Secure Software: How to avoid Security Problems in the Right Way, Viega, J and MC Graw G., Addison-Wesley, 1st Edition, 2001.
2. The Open Web Application Security Project: A Guide to Building Secure Web Applications and Web Services, 2.0 Black Hat Edition, 2005

Web Links:

1. http://www.sis.pitt.edu/jjoshi/Devsec/secureSoftware.pdf
2. http://www.cs.unh.edu/~it666/reading_list/SDLC/ms_sdl_agile.pdf
3. http://ptgmedia.pearsoncmg.com/images/9780321509178/samplepages/032150917X_Sample.pdf
4. http://www.cs.ccsu.edu/~stan/classes/CS410/Notes16/13-Security Engineering.html
5. https://dl.acm.org/citation.cfm?id=1406308

BIG DATA ANALYTICS
(Professional Elective-IV)

II Semester **L T P C**
Course Code: 192SE2E10 **3 0 0 3**

Course Objectives:

COB 1: To demonstrate data structures using java collection framework.
COB 2: To explain building blocks and installation modes of Hadoop.
COB 3: To describe Map Reduce approach for big data problems.
COB 4: To describe PIG programming tool of Hadoop echo system.
COB 5: To explain Hive installation and Hive query language.

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

CO 1: Develop various data structures using java collection framework.
CO 2: Construct Hadoop Cluster with required nodes.
CO 3: Choose map reduce approach to solve big data Problems.
CO 4: Make use of Pig Framework to work with bigdata.
CO 5: Utilize Hive to Structure the Data.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO1 (K5)	PO2 (K4)	PO3 (K5)	PO4 (K3)	PO5 (K3)	PO6 (K4)	PO7 (K6)	PO8 (K2)	PO9 (K2)	PO 10 (K2)	PO 11 (K4)
CO1(K3)	1	---	---	3	3	---	---	---	---	---	---
CO2(K3)	3	3	---	---	3	---	---	---	---	---	---
CO3(K3)	1	2	1	3	3	2	---	3	3	3	---
CO4(K2)	1	2	1	3	3	2	---	3	3	---	---
CO5(K3)	1	2	1	3	3	2	---	3	---	---	---

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2 (K3)	PSO 3 (K3)
CO1 (K3)	2	2	2
CO2 (K3)	3	-	-
CO3 (K3)	-	-	2
CO4 (K2)	-	2	-
CO5 (K3)	2	2	2

UNIT-I:
What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

UNIT-II:
Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized

views, distribution models, sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, Working with Cassandra – Table creation, loading and reading data.

UNIT-III:
Data formats, analyzing data with Hadoop, scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance –with data replication, High availability, Data locality , Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization. Introduction to Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, Logical joins, Window functions, Optimization- Table partitioning, Bucketing, Indexing, Join strategies.

UNIT-IV:
Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Data frames ,RDD to Data frames, Catalyst optimizer, Data Frame Transformations, Working with Dates and Timestamps, Working with Nulls in Data, Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers Standalone Mode, Spark on YARN , Spark Logs, The Spark UI- Spark UI History Server, Debugging and Spark First Aid

UNIT-V:
Spark-Performance Tuning, Stream Processing Fundamentals, Event-Time and State full Processing - Event Time, State full Processing, Windows on Event Time-Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream, Structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.

Text Books:
1. Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging
2. SPARK: The Definitive Guide, Bill Chambers &Matei Zaharia, O' Reilley, 2018 Edition
3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
4. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional, 2012.
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.

Reference Books:
1. Eric Sammer, "Hadoop Operations", O' Reilley, 2012.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O' Reilley, 2012.
3. Lars George, "HBase: The Definitive Guide", O' Reilley, 2011.
4. Eben Hewitt, "Cassandra: The Definitive Guide", O' Reilley, 2010.
5. Alan Gates, "Programming Pig", O' Reilley, 2011.

Web Links:

1. Hadoop:http://hadoop.apache.org/
2. Hive:https://cwiki.apache.org/confluence/display/Hive/Home
3. Piglatin: http://pig.apache.org/docs/r0.7.0/tutorial.html
4. http://nptel.ac.in/courses/106106142/
5. https://hortonworks.com/tutorial/how-to-process-data-with-apache-hive/

DESIGN PATTERNS
(Professional Elective-IV)

II Semester **L T P C**
Course Code: 192SE2E11 **3 0 0 3**

Course Objectives:

COB 1: To impart the knowledge on design patterns.
COB 2: To make the students learn the need of design patterns in software development.
COB 3: To provide the knowledge on structural patterns.
COB 4: To provide the knowledge on Behavioural patterns.
COB 5: To demonstrate different types of design patterns.

Course Outcomes:
At the end of this course the student will be able to:

CO 1: Apply design patterns to solve design problems.
CO 2: Discuss different types design patterns.
CO 3: Compare and contrast various design patterns.
CO 4: Solve design problems using structural design patterns
CO 5: Make use of Behavioural patterns to solve proble006D

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)	1	-	-	2	-	-	-	-	-	-	-
CO2 (K2)	1	-	-	-	-	2	3	-	-	-	-
CO3 (K2)	-	-	-	-	-	2	3	-	-	-	-
CO4 (K4)	-	-	-	3		2	3	-	-	-	-
CO5 (K3)	1	-	-	-	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K3)
CO1 (K3)	2	3	3
CO2 (K2)	2	2	3
CO3 (K2)	2	2	3
CO4 (K4)	2	2	3
CO5 (K3)	2	3	3

UNIT-I:
Introduction:
History and Origin of Patterns, Design Patterns in MVC, Describing Design Patterns, How Design Patterns Solve Design Problems, Selecting a Design Pattern, Using a Design Pattern.

UNIT-II:
Design Patterns-1: Creational, Abstract Factory-Builder, Factory Method, Prototype Singleton.

UNIT- III:
Design Patterns-2: Structural Patterns: Adapter, Bridge, Composite Decorator, Façade, Flyweight, Proxy

UNIT-IV:
Design Patterns-3: Behavioral Patterns, Chain of Responsibility, Command-Interpreter, Iterator- Mediator, Memento, Observer, State, Strategy, Template Method, Visitor

UNIT-V:
Advanced Patterns: Pattern Catalogs and Writing Patterns, Patterns and Case Study: Designing a Document Editor Anti-Patterns - Case Studies in UML and CORBA, Pattern Community

Text Books:

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Design patterns: Elements of Reusable object-oriented software, Addison-Wesley, 1995.
2. James W Cooper, Java Design Patterns - A Tutorial, Addison-Wesley, 2000.

Reference Books:

1. Craig Larman, Applying UML and Patterns: An Introduction to object- oriented Analysis and Design and iterative development ,3/e, Pearson, 2005.
2. Thomas J Mowbray and Raphael Malveau, CORBA and Design Patterns, John Wiley, 1997.
3. William J Brown, Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis, John Wiley, 1998.

SOFTWARE TESTING LAB

II Semester **L T P C**
Course Code: 192SE2L03 **0 0 4 2**

Course Objectives:

COB 1: To facilitate the students study different testing tools.
COB 2: To demonstrate the working of software testing tools with JAVA language.
COB 3: To impart knowledge on testing tools.
COB 4: To make the students develop test cases for various applications

Course Outcomes:

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

CO 1: Experiment with various Java programs for writing test cases.
CO 2: Construct manual test cases for different software modules.
CO 3: Develop test cases for various Case studies.
CO 4: Apply any testing tool for implementing automation testing.
CO 5: Design the test cases for checking GUI objects.

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	-	-	-	-	3	-	-	-	-
CO2 (K6)	3	3	3	3	3	-	3	-	-	-	-
CO3 (K3)	3	2	-	-	-	-	3	-	-	-	-
CO4 (K3)	3	2	1	1	3	-	3	-	-	-	-
CO5 (K6)	3	3	3	3	3	-	3	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K3)
CO1 (K3)	3	-	-
CO2 (K6)	-	-	3
CO3 (K3)	3	-	-
CO4 (K3)	3	3	-
CO5 (K6)	-	3	3

List of Experiments:

1. Study various tools such as Win Runner, Load Runner, Test Director, Rational Rose Suite etc.

2. Perform experiments to do the following: a. Requirements Testing b. Use – case Scenario Testing c. Unit Testing d. Regression Testing e. Integration Testing f. Validation Testing g. Acceptance Testing h. System Testing

3. Prepare test plan and develop test case hierarchy

4. Generate Test cases and Test Documentation in the following case studies a. Library System b. Course Registration System c. Implement a Quiz System d. Student Marks Analyzing System e. Online Ticket Reservation System

5. Recording test in analog and context sensitive mode

6. Synchronizing test

7. Checking GUI Objects

8. Checking Bitmap Objects

9. Creating data driven test

10. Maintaining test script

Reference Books:

1. Software Automation Testing Tools for Beginners, Rahul Shende, Shroff Publishers & Distributors Pvt. Ltd.
2. The Art of Application Performance Testing: From Strategy to Tools, Ian Molyneaux, O' Reilly Media.
3. Managing the Testing Process: Practical Tools and Techniques for Managing Hardware and Software Testing, Rex Black, WILEY.

Web Links:

1. http://www.aptest.com/resources.html
2. http://www.softwaretestinghelp.com/test-case-template-examples/
3. https://www.guru99.com/automation-testing.html
4. https://www.guru99.com/selenium-tutorial.htm
5. https://www.tutorialspoint.com/jenkins/

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SOFTWARE ENGINEERING LAB-II

II Semester	**L**	**T**	**P**	**C**
Course Code: 192SE2L04	**0**	**0**	**4**	**2**

Course Objectives:

COB 1: To provide the knowledge on writing SRS for any project.
COB 2: To impart the knowledge on function oriented diagrams
COB 3: To make the students develop various uml diagrams.
COB 4: To describe to calculate estimation of effort for various applications.

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

CO 1: Develop Software Requirement Specifications for various case studies.
CO 2: Construct function oriented diagrams for any project.
CO 3: Build structural, behavioral, and view diagrams.
CO 4: Examine estimation of effort using FP estimation for any project.
CO 5: Develop time line chart, Gantt chart, PERT chart for various projects.

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	-	-	-	-	-	-	-	-	-
CO2 (K3)	3	-	3	-	3	-	-	-	-	-	-
CO3 (K3)	3	2	-	-	-	-	-	-	-	-	-
CO4 (K4)	3	-	1	-	3	-	-	-	-	-	-
CO5 (K3)	3	3	-	3	3	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes:

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K3)
CO1 (K3)	3	-	-
CO2 (K3)	-	-	3
CO3 (K3)	3	-	-
CO4 (K4)	3	3	-
CO5 (K3)	-	3	3

List of Experiments:

Service Oriented Architecture programs:

1. Create a web service client for addition operation
2. Create a web service for finding factorial of given number
3. Login web service for used to accessing the operations are adding user, and test the service, invoke the two operations using the JSP client.
4. JAX-WS –Order Processing service and its client.
5. EJB-Bean Components for Payroll and ATM Applications.
6. Invoke EJB component as web service using Netbeans IDE
7. Invoking ASP.Net web service using J2EE
8. Invoking J2EE web service in ASP.Net using C#

Big Data Analytics programs:

1. (i) Perform setting up and Installing Hadoop in its three operating modes: Standalone, Pseudo distributed, fully distributed
   (ii) Use web based tools to monitor your Hadoop setup.
2. Implement the following file management tasks in Hadoop:
   • Adding files and directories
   • Retrieving files
   • Deleting files

Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilitie

3. Run a basic Word Count MapReduce program to understand MapReduce Paradigm.
4. Write a Mapreduce program that mines weather data. Weather sensors collecting data every hour at many locations across the Globe Gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented.
5. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.

Design Patterns programs:

1. Using UML design the following Design patterns
   - Abstract factory
   - Builder
   - Façade
   - Bridge
   - Decorator
2. User gives a print command from a word document. Design to represent this chain of responsibility design pattern.

Reference Books:

1. K.K. Aggarwal & Yogesh Singh, ―Software Engineering‖, New Age International, 2005.
2. Pankaj Jalote, ―An Integrated Approach to Software Engineering‖, Second Edition, Springer.

Web Links:

1. http://www.softwaretestinghelp.com/test-case-template-examples/
2. https://www.tutorialspoint.com/jenkins/
3. http://www.aptest.com/resources.html

ENGLISH FOR RESEARCH PAPER WRITING

I or II Semester **L T P C**
Course Code: 192MC1A01 or 192MC2A01 **2 0 0 0**

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

CO 1 Understand how to improve the writing skills and level of readability.
CO 2 Illustrate what to write in each section.
CO 3 Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission.

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)	-	-	-	2	-	-	-	2	2	-	-
CO 2(K2)	-	-	-	2	-	-	-	2	2	-	-
CO 3(K2)	-	-	-	2	-	-	-	2	2	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO/PSO	PSO 1 (K4)	PSO 2 (K3)	PSO 3 (K2)
CO 1(K2)	1	2	3
CO 2(K2)	1	2	3
CO 3(K2)	1	2	3

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness**.**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction.

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions**.**

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

Text Books:

1. Gold bort R (2006) Writing for Science, Yale University Press (available on Google Books).
2. Day r (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.

3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman" sbook.
4. Adrian Wall work, English for Writing Research Papers, Springer New York Dordrech Heidelberg London, 2011.

DISASTERMANAGEMENT

I or II Semester	L	T	P	C
Course Code:192MC1A02 or 192MC2A02	2	0	0	0

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

CO 1 Demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO 2 Evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO 3 Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO 4 Understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

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	-
CO 4(K2)	-	-	-	-	-	-	-	-	-	1	-

Mapping of Course Outcomes with Program Specific Outcomes

CO/PSO	PSO 1 (K4)	PSO 2 (K3)	PSO 3 (K2)
CO 1(K2)	-	-	3
CO 2(K2)	-	-	3
CO 3(K2)	2	-	3
CO 4(K2)	2	1	3

Introduction:
Disaster: Definition, Factors and Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Repercussions of Disasters and Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem.
Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks of Disease And Epidemics, War And Conflicts.

Disaster Prone Areas in India
Study of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics**.**

Disaster Preparedness and Management

Preparedness: Monitoring of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Risk Assessment

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Disaster Mitigation

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Text Books:

1. R.Nishith,SinghAK,"DisasterManagementinIndia:Perspectives,issuesandstrategies"New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.), "Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. GoelS.L., Disaster Administration And Management Text And Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi.

SANSKRITFORTECHNICALKNOWLEDGE

I or II Semester	L	T	P	C
Course Code: 192MC1A03 or 192MC2A03	2	0	0	0

Course Outcomes:

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

CO 1: Understanding basic Sanskrit language.
CO 2: Develop the brain functioning in association with Sanskrit Language.
CO 3: Use logical language will help to develop logic in students.
CO 4: Understand the importance of Sanskrit Language to explore ancient literature.

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	-	-
CO 4(K2)	-	-	-	-	-	-	-	-	1	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO/PSO	PSO 1 (K4)	PSO 2 (K3)	PSO 3 (K2)
CO 1(K2)	-	-	-
CO 2(K2)	-	-	-
CO 3(K2)	-	-	-
CO 4(K2)	-	-	-

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

Order, Introduction of roots, Technical information about Sanskrit Literature**.**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics**.**

Text Books:

1.“Abhyas pustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi.
2.“TeachYourself Sanskrit ”Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication.
3.“India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P)Ltd.,New Delhi.

VALUE EDUCATION

I or II Semester	L	T	P	C
Course Code: 192MC1A04 or 192MC2A04	2	0	0	0

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

CO 1: Understand value of education and self- development.
CO 2: Explain the need of good values in students.
CO 3: Developing the overall personality.
CO 4: Explain the need of character in a student.

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	-
CO 4(K2)	-	-	-	-	-	-	-	-	-	1	-

Mapping of Course Outcomes with Program Specific Outcomes

CO/PSO	PSO 1 (K4)	PSO 2 (K3)	PSO 3 (K2)
CO 1(K2)	-	-	1
CO 2(K2)	-	-	1
CO 3(K2)	-	-	1
CO 4(K2)	-	-	1

Values and self-development–Social values and individual attitudes. Work ethics, Indian vision of humanism, Moral and non-moral valuation. Standards and principles, Value judgements.

Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism. Love for nature, Discipline.

Personality and Behavior Development-Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship. Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature.

Character and Competence –Holy books vs Blind faith, Self-management and Good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively.

Text Books:

1. Chak roborty,S.K.“ValuesandEthicsfororganizationsTheoryandpractice”,OxfordUniversity Press, New Delhi.

CONSTITUTION OF INDIA

I or II Semester	L	T	P	C
Course Code: 192MC1A05 or 192MC2A05	2	0	0	0

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

CO 1 : Describe growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
CO 2 : Explain the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
CO 3 : Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
CO 4 : Demonstrate the passage of the Hindu Code Bill of 1956.

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)											
CO 2(K2)											
CO 3(K2)											
CO 4(K2)											

Mapping of Course Outcomes with Program Specific Outcomes

CO/PSO	PSO 1 (K4)	PSO 2 (K3)	PSO 3 (K2)
CO 1(K2)	-	1	-
CO 2(K2)	-	1	-
CO 3(K2)	-	1	-
CO 4(K2)	-	1	-

History of Making of the Indian Constitution: History.
Drafting Committee, (Composition &Working)**.**

Philosophy of the Indian Constitution:
Preamble Salient Features.

Contours of Constitutional Rights & Duties:
Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation**,** Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Organs of Governance:
Parliament Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions**.**

Ocal Administration:

District's Administration head: Role and Importance,
Municipalities: Introduction, Mayor and role of Elected Representative, CE of Municipal Corporation.
Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles.
CEO Zila Pachayat: Position and role.
Block level: Organizational Hierarchy(Different departments),
Village level: Role of Elected and Appointed officials, Importance of grassroot democracy**.**

Election Commission:
Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners.
State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books:

1.The Constitution of India, 1950 (Bare Act), Government Publication.
2.Dr. S. N. Busi, Dr. B. R.Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3.M. P.Jain, Indian Constitution Law, 7th Edn.,Lexis Nexis, 2014.
4.D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

PEDAGOGY STUDIES

I or II Semester	L	T	P	C
Course Code: 192MC1A06 or 192MC2A06	2	0	0	0

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

CO 1: Distinguish the various pedagogical practices are being used by teachers informal and informal classrooms in developing countries.
CO 2: Explain the evidence on the effectiveness of various kinds of pedagogical practices, indifferent conditions.
CO 3: Discuss the teacher's attitudes and beliefs in line with pedagogic strategies.
CO 4: Prepare school curriculum and guidance material best support effective pedagogy.
CO 5: List the research gaps.

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)
CO 1(K2)	-	-	-	-	-	-	-	-	1	-	-
CO 2(K2)	-	-	-	-	-	-	-	-	1	-	-
CO 3(K2)	-	-	-	-	-	-	-	-	1	-	-
CO 4(K2)	-	-	-	-	-	-	-	-	1	-	-
CO 4(K2)	-	-	-	-	-	-	-	-	1	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO/PSO	PSO 1 (K4)	PSO 2 (K3)	PSO 3 (K2)
CO 1(K2)	-	-	1
CO 2(K2)	-	-	-
CO 3(K2)	-	-	-
CO 4(K2)	-	-	-
CO 5(K2)	1	1	3

Introduction and Methodology:
Aimsandrationale, Policy background, Conceptual frame work and terminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions**,** Overview of methodology and Searching.

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education.

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies, How can teacher education(curriculum and practicum)and the school curriculum and guidance materials best support effective pedagogy? Theory of change, Strength and nature of the body of evidence for effective pedagogical practices, Pedagogic theory and pedagogical approaches, Teachers‟ attitudes and beliefs and Pedagogic strategies.

Professional development: alignment with class room practices and follow-up support. Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Research Gaps and Future Directions:
Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Text Books:

1 AckersJ,HardmanF(2001)ClassroominteractioninKenyanprimaryschools,Compare,31 (2): 245-261.
2 AgrawalM(2004)Curricularreforminschools:Theimportanceofevaluation,Journalof Curriculum Studies, 36 (3): 361-379.
3 AkyeampongK(2003)TeachertraininginGhana-doesitcount?Multi-siteteachereducation research project (MUSTER) country report 1.London: DFID.
4 A kyeampong K, LussierK, PryorJ, Westbrook J(2013) Improving teaching and learning of basic Maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5 AlexanderRJ(2001)Cultureandpedagogy:Internationalcomparisonsinprimary education. Oxford and Boston: Blackwell.
6 Chavan M (2003)Read India: A mass scale, rapid, „learning to read" campaign.

Web Link:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.

STRESSMANAGEMENTBYYOGA

I or II Semester **L T P C**
Course Code:192MC1A07 or 192MC2A07 **2 0 0 0**

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

CO 1: Develop healthy mind in a healthy body to improve social health.

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)
CO 1(K2)	-	-	-	-	-	-	-	-	1	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO/PSO	PSO 1 (K4)	PSO 2 (K3)	PSO 3 (K2)
CO 1(K2)	-	-	-

Definitions of Eight parts of yog.(Ashtanga):
Yam and Niyam. Do`s and Dont's in life:

i) Ahinsa, satya, astheya, bramhacharya andaparigraha.
ii) Shaucha, santosh, tapa, swadhyay, Ishwar pranidhan**.**

As an and Pranayam:

1. Variousyogposes andtheir benefits for mind &body.
2. Regularization of breathing techniques and its effects-Types of pranayama.

Text Books:

1. "Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yoga bhyasi Mandal, Nagpur.
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.

PERSONALITYDEVELOPMENTTHROUGHLIFEENLIGHTENMENTSKILLS

I or II Semester	L	T	P	C
Course Code: 192MC1A08 or 192MC2A08	2	0	0	0

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

CO 1: Develop his/her personality and achieve the highest goal in life.
CO 2: Capable of lead the nation and mankind to peace and prosperity.
CO 3: Develop versatile personality of students.

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)
CO 1(K2)	-	-	-	-	-	-	-	-	1	-	-
CO 2(K2)	-	-	-	-	-	-	-	-	1	-	-
CO 3(K2)	-	-	-	-	-	-	-	-	1	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO/PSO	PSO 1 (K4)	PSO 2 (K3)	PSO 3 (K2)
CO 1(K2)	-	-	1
CO 2(K2)	-	-	1
CO 3(K2)	-	-	1

Neetisatakam-Holistic development of personality
Verses- 19,20,21,22(wisdom), Verses- 29,31,32(pride & heroism), Verses- 26,28,63,65(virtue), Verses- 52,53,59(dont‟s), Verses- 71,73,75,78(do‟s)**.**

Approach to day to daywork and duties, Shrimad Bhagwad Geeta: Chapter2-Verses 41, 47,48, Chapter3-Verses 13, 21,27, 35, Chapter6-Verses5,13,17, 23, 35, Chapter18-Verses 45, 46, 48.

Statements of basic knowledge, Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68, Chapter12 -Verses 13, 14, 15, 16,17, 18, PersonalityofRolemodel.ShrimadBhagwadGeeta:Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter4-Verses 18, 38,39,
Chapter18 – Verses 37,38,63**.**

Text Books:
1.“SrimadBhagavadGita”bySwamiSwarupanandaAdvaitaAshram(Publication Department), Kolkata.
2. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

SOFT SKILLS
(Common to all branches)

I or II Semester	L	T	P	C
Course Code:192MC1A09 or 192MC2A09	2	0	0	0

Course Objectives:

COB 1: To provide necessary training to impart soft skills.
COB 2: To ensure the students to secure placements.
COB 3: To make the students to feel comfortable to face several competitive examinations with confidence and competence.
COB 4: To make the student more likely to be employed.

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

CO 1: Summarize the basic grammatical skills.
CO 2: Understand interview skills & importance of business etiquette.
CO 3: Apply typical write-up skills for business need.
CO 4: Prepare a professional resume.
CO 5: Use the tools of the soft skills.

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)
CO 1(K3)	-	-	-	-	-	-	-	2	-	-	-
CO 2(K3)	-	-	-	-	-	-	-	2	-	-	-
CO 3(K2)	-	-	-	-	-	-	-	2	-	-	-
CO 4(K4)	-	-	-	-	-	-	-	2	-	-	-
CO 5(K3)	-	-	-	-	-	-	-	2	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO/PSO	PSO 1 (K4)	PSO 2 (K3)	PSO 3 (K2)
CO 1(K2)	-	1	1
CO 2(K2)	-	1	1
CO 3(K2)	-	1	1
CO 4(K2)	-	1	1
CO 5(K2)	-	1	1

UNIT-I:
Group discussion.

UNIT-II:
Resume writing, Personalized Resume preparation.

UNIT-III:
Speech-Debate-JAM-Importance-Do &Don’ts.

UNIT-IV:

Interviewing skills-1,Do's& don'ts in an interview, Interview Demonstration Videos, Interview Preparation.

UNIT-V:

E-mail -Writing &Etiquette, Business Etiquette.

Text Books:

1. Soft skills: Enhancing employability M.S. RAO,WILEY publications.
2. Soft skills: An integrated approach to maximize personality - Gajendra singh chauhan & sangeetha sharma.

Reference Books:

1. Communication Skills and Soft Skills: An Integrated Approach.
2. Presentation Skills for Technical Professionals: Achieving Excellence (Soft Skills for IT Professionals)by Naomi Karten, IT Governance Publishing.
3. A New Approach to Objective English -R.S. Dhillon DGP Publications.

OBJECT ORIENTED SOFTWARE ENGINEERING
(Professional Elective-V)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192SE3E12	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To enable the students to learn different software development models.
COB 2: To illustrate different cost estimation models.
COB 3: To impart the knowledge on requirements, analysis and design workflow.
COB 4: To make the students learn different testing strategies.
COB 5: To demonstrate software quality and maintenance.

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

CO 1: Compare and contrast different software development models.
CO 2: Summarize different cost estimation models.
CO 3: Make use of requirements, analysis and design workflows in development of a product.
CO 4: Apply different testing strategies.
CO 5: Explain about software configuration and maintenance.

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 (K4)	2	3	3	3	2	2	-	-	-	-	-
CO2 (K2)	2	1	-	-	2	2	-	-	-	-	-
CO3 (K3)	3	2	1	1	3	3	-	-	-	-	-
CO4 (K3)	3	2	1	1	3	3	-	-	-	-	-
CO5 (K5)	-	2	3	3	-	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K3)
CO1 (K4)	2	2	2
CO2 (K2)	1	1	1
CO3 (K3)	3	3	3
CO4 (K3)	3	3	3
CO5 (K5)	1	-	-

UNIT–I:
Introduction to Software Engineering:
What is Software Engineering, Software Engineering Concepts, Software Engineering Development Activities, Managing Software Development, Case Study
Modeling with UML: Introduction – Overview of UML – Modeling Concepts – Deeper View into UML.

UNIT–II:

Project Organization and Communications:

Introduction, An Overview of Projects, Project Organization Concepts, Project Communication Concepts, Organizational Activities

Analysis: Introduction, Overview of Analysis, Analysis Concepts, Analysis Activities, Managing Analysis, Case study.

UNIT–III:

System Design:

Overview of System Design, System Design Concepts, System Design activities, Managing System Design, Case study

Object Design: Overview of Object design, Reuse Concepts, Reuse Activities, Managing Reuse, Case study.

UNIT–IV:

Mapping Models to Code:

Overview of mapping, Mapping concepts, Mapping Activities, Mapping Implementation, Case study

Configuration Management and Project Management: Configuration Management Overview, Concepts, Activities and Managing Configuration Management, Overview of Project management, Project Management Concepts, Project Management Activities.

UNIT–V:

Software Life Cycle:

Introduction, IEEE 1074, Characterizing the Maturity to Software Life Cycle Models, Life cycle Models

Methodologies: Introduction, Project Environment, Methodology Issues, A Spectrum of Methodologies, Case studies.

Text Books:

1. Object-Oriented Software Engineering: Practical software development using UML, Patterns and java, Second Edition, Bernd Bruegge and Allen Dutoit, Pearson Education, 2004. ISBN10:

Reference Books:

1. Object-Oriented Software Engineering: Conquering Complex and Changing Systems, Bernd Bruegge and Allen H. Dutoit, Pearson Education,2002. ISBN 0-13-489725-0
2. Object-oriented Software Engineering: The Professional Developer's Guide, Addison Wesley, George Wilkie, 1993. ISBN-10: 0201627671

Web Links:

1. www.mhhe.com/engcs/compsci/pressman/
2. www.software-engineer.org.
3. www.mhhe.com/engcs/compsci/schach/
4. www.qozi.com/engineering/
5. www.sei.cmu.edu

ARTIFICIAL INTELLIGENCE
(Professional Elective – V)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192SE3E13	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To enable the students to learn AI concepts.
COB 2: To illustrate different searching techniques.
COB 3: To impart the knowledge on various logical systems.
COB 4: To make the students learn different knowledge representation techniques.
COB 5: To facilitate the students to fuzzy logic and reasoning to solve scientific problems.

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

CO 1: Describe the fundamentals of Artificial Intelligence and its applications.
CO 2: Illustrate the time and space complexities of searching techniques.
CO 3: Apply various logical systems to inference the different logical problems.
CO 4: Create knowledge structure using traditional and complex structures and Advanced knowledge representation techniques.
CO 5: Apply Fuzzy Logic and Reasoning to handle Uncertainty for solving scientific Problems.

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)	2	1	-	-	2	-	-	-	-	-	-
CO3 (K3)	3	2	1	1	3	-	-	-	-	-	-
CO4 (K3)	3	2	1	1	3	-	-	-	-	-	-
CO5 (K3)	3	2	1	1	3	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K3)
CO1 (K2)	2	2	2
CO2 (K2)	2	2	2
CO3 (K3)	3	3	3
CO4 (K3)	3	3	3
CO5 (K3)	3	3	3

UNIT-I:
Introduction to Artificial Intelligence:
Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of ai languages, current trends in AI

UNIT-II:
Problem Solving:
state-space search and control strategies: Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative-deepening a*, constraint satisfaction

Problem Reduction and Game Playing: Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games.

UNIT-III:
Logic Concepts:
Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic.

UNIT-IV:
Knowledge Representation:
Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames
Advanced Knowledge Representation Techniques: Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web

UNIT-V:
Expert System and Applications:
Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools

Text Books:
1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning
2. Artificial intelligence, A modern Approach , 2nd ed, Stuart Russel, Peter Norvig, PEA
3. Artificial Intelligence- Rich, Kevin Knight, Shiv Shankar B Nair, 3rd ed, TMH
4. Introduction to Artificial Intelligence, Patterson, PHI

Reference Books:
1. Artificial intelligence, structures and Strategies for Complex problem solving, -George F Lugar, 5th ed, PEA
2. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
3. Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier

Web Links:
1. https://www.tutorialspoint.com/artificial_intelligence/
2. https://onlinecourses.nptel.ac.in/noc17_cs30/
3. https://www.slideshare.net/girishnaik/artificial-intelligence-3638681/
4. https://www.mindmeister.com/44054594/expert-systems/
5. https://in.udacity.com/course/intro-to-artificial-intelligence--cs271/

USER INTERFACE DESIGN
(Professional Elective – V)

III Semester **L T P C**
Course Code: 192SE3E14 **3 0 0 3**

Course Objectives:

COB 1: To demonstrate guidelines, principles and theories influencing human computer interaction.
COB 2: To enable the students to recognize how a computer system may be modified to include human diversity.
COB 3: To make the students to utilize an effective style for a specific application.
COB 4: To make the students aware of the methodologies and technologies supporting advances in HCI.
COB 5: To impart the knowledge of Designing mock ups.

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

CO 1: Identify the importance of user interface in real time applications.
CO 2: Illustrate the concept of graphical user interface and the screen design principles for effective screen design.
CO 3: Illustrate screen designing goals and technological consideration in interface design.
CO 4: Demonstrate components and software tool specification methods.
CO 5: Identify different interactive devices for User Interface Design.

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 (K3)	3	2	1	1	3	-	-	-	-	-	-
CO2 (K2)	2	1	-	-	-	-	-	-	-	-	-
CO3 (K2)	2	1	-	-	-	-	-	-	-	-	-
CO4 (K2)	2	1	-	-	-	-	-	-	-	-	-
CO5 (K3)	3	2	1	1	3	-	-	-	-	-	-

Mapping of Course Outcomes with Program Specific Outcomes

CO / PSO	PSO 1(K3)	PSO 2(K3)	PSO 3(K3)
CO1 (K3)	3	3	3
CO2 (K2)	2	2	2
CO3 (K2)	2	2	2
CO4 (K2)	2	2	2
CO5 (K3)	3	3	3

UNIT-I:
Introduction:
Importance of user Interface, definition, importance of good design. Benefits of good design. A brief history of Screen design.

The Graphical User Interface: Popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – interface popularity, characteristics- Principles of user interface.

UNIT-II:
Design Process:
Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions.

UNIT-III:
Screen Designing:
Design goals, Screen planning and purpose, organizing screen elements, ordering of screen data and content, screen navigation and flow, Visually pleasing composition, amount of information, focus and emphasis, presentation information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design.

UNIT-IV:
Windows:
Windows new and Navigation schemes selection of window, selection of devices based and screen based controls.
Components: Components text and messages, Icons and increases, Multimedia, colors, uses problems, choosing colors.

UNIT-V:
Software Tools:
Specification methods, interface, Building Tools.
Interaction Devices: Keyboard and function keys, pointing devices, speech recognition digitization and generation, image and video displays, drivers.

Text Books:

1. Human Computer Interaction, Alan Dix, Janet Finlay, Goryd, Abowd, Russell Beal, PEA, 3rd Edition, 2004.
2. The Essential guide to user interface design, Wilbert O Galitz, Wiley Dreama Tech, 2nd Edition.

Reference Books:

1. Designing the user interface, Ben Shneidermann, PEA, 4th Edition.
2. User Interface Design, Soren Lauesen, PEA, 2nd Edition.

Web Links:

1. https://www.freshtilledsoil.com/what-is-user-interface-design/
2. https://www.coursera.org/specializations/user-interface-design
3. http://learnui.design/
4. https://stats.bls.gov/ore/htm_papers/st960150.htm
5. http://nptel.ac.in/syllabus/106103115/

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REPAIR&REHABILITATION OF STRUCTURES

(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192ST3O01	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To make the students to learn the various types and properties of repair materials.
COB 2: To impart knowledge on available techniques and their application for strengthening or upgrading existing structural systems.
COB 3: To demonstrate the students on various repair techniques of damaged structures.
COB 4: To create awareness on usage of basic and advanced concretes.
COB 5: To enable to Illustrate the concepts high performance concretes.

Course Outcomes:

At the end of the Course, Student will be able to003A

CO 1: Identify the causes of deterioration of concrete structures.
CO 2: Illustrate the various materials for repair and rehabilitation techniques.
CO 3: Construct the various strengthening and stabilization techniques.
CO 4: Determine various repair techniques of damaged structures.
CO 5: Evaluate the usage of different types of concretes and durability aspects.
CO 6: Classify the usage of high performance concretes for repairing works.

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 (K3)	1	-	-	-	3	-	-	-	-	-	-
CO2 (K2)	-	-	-	-	2	-	-	-	-	-	-
CO3 (K3)	1	-	-	-	3	-	-	-	-	-	-
CO4 (K5)	3	-	-	-	3	-	-	-	-	-	-
CO5 (K5)	3	-	-	-	3	-	-	-	-	-	-
CO6 (K4)	3	-	-	-	3	-	-	-	-	-	-

UNIT-I:

Materials for Repair and Rehabilitation:

Admixtures- types of admixtures-purposes of using admixtures-chemicalcomposition-Naturaladmixtures-Fibers-wraps-GlassandCarbonfiber wraps- Steel Plates-Non destructive evaluation: Importance- Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects – Visual investigation-A coustical emission methods-Corrosion activity measurement-chloride content– Depth of carbonation- Impact echo methods-Ultrasound pulse velocity methods- Pull out tests.

UNIT-II:

Strengthening and Stabilization:

Techniques- design considerations-Beam shear capacity strengthening- Shear Transfer strengthening-stress reduction techniques- Column strengthening-

flexural strengthening- Connection stabilization and strengthening, Crack stabilization.

UNIT–III:
Bonded Installation Techniques:
Externally bonded FRP- Wet layup sheet, bolted plate, near surface mounted FRP, fundamental debonding mechanisms-intermediate crack debonding-CDCdebonding-plateenddebonding-strengtheningoffloorofstructures.

UNIT-IV:
Fibre Reinforced Concrete:
Properties of constituent materials- Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes-Light weight concrete- properties of light weight concrete-No fines concrete- design of light weight concrete- Fly ash concrete-Introduction-classification of fly ash-properties and reaction mechanism of fly ash-Properties of fly ash concrete in fresh state and hardened state-Durability of fly ash concretes.

UNIT-V:
High Performance Concrete:
Introduction- Development of high performance concretes- Materials of high performance concretes- Properties of high performance concretes-Self Consolidating concrete-properties- qualifications.

Text Books:

1. Concrete repair and maintenance illustrated-Peter Emmons, published by Brandon W. Emmons.
2. Repair and rehabilitation of concrete structures, Poonam I.Modi,Chirag N. patel, published by PHI Learning .
3. Rehabilitation of Concrete Structures, Dr. B. Vidivelli, Standard Publishers Distributors.

Reference Books:

1. Special Structural concrete-Rafat Siddique, Galgotia Publications.
2. Concrete technology, M S Shetty, S. Chand Publications.
3. Concrete technology, Neville & Brooks, Pearson education ltd.

Web Links:

1. http://nptel.ac.in/courses/112101095/38
2. http://www.nptel.ac.in/courses/105105041/module%206.pdf
3. https://www.youtube.com/watch?v=N4KrZ_DczrE

GREEN BUILDING SYSTEMS
(Open Elective)

III Semester	L	T	P	C
Course Code: 192ST3O02	3	0	0	3

Course Objectives:

COB 1: Learn the principles of planning and orientation of green buildings.
COB 2: Acquire knowledge on various aspects of green buildings

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

CO 1: Explain the principles of green building planning, its bylaws.
CO 2: Explain the concepts of green building materials.
CO 3: Use concept of energy and resource conversion in green building construction.
CO 4: Use of renewable energy resources in green building design**.**
CO 5: Design climate for green buildings**.**

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	2	1	-	-	-	-	-
CO2 (K2)	-	1	-	2	2	1	-	-	-	-	-
CO3 (K3)	1	2	1	3	3	2	-	-	-	-	-
CO4 (K4)	2	3	2	3	3	3	-	-	-	-	-
CO5 (K2)	-	1	-	2	2	1	-	-	-	-	-

UNIT-I:
Green Buildings:
Definition of Green Buildings, typical features of green buildings, benefits of Green Buildings- Sustainable site selection and planning of buildings to maximize comfort, day lighting, ventilation, planning for storm water drainage

UNIT-II:
Environmentally Friendly Building Materials and Technologies:
Natural Materials like bamboo, timber, rammed earth, stabilized mud blocks, hollow blocks, lime & lime-pozzolana cements, materials from agro and industrial waste, ferro-cement and ferro-concrete, alternative roofing systems, various paints reducing the heat gain of the building, etc.

UNIT–III:
Energy and Resource Conservation:
Need for energy conservation, various forms of energy used in buildings, embodied energy of materials, energy used in transportation and construction processes- water conservation systems in buildings-water harvesting in buildings – waste to energy management in residential complexes or gated communities.

UNIT-IV:

Use of Renewable Energy Resources:

Wind and Solar Energy Harvesting, potential of solar energy in India and world, construction and operation of various solar appliances, success case studies of fully solar energy based buildings in India.

UNIT-V:

Climate Design:

Local climatic conditions – temperature, humidity, wind speed and direction-impact of climate change on built environment – comforts: the desirable conditions – Principles of thermal design – means of thermal –light and lighting-building acoustics- energy efficient lighting, Ventilation and air quality requirement, various techniques for passive cooling, garden roofs, case studies for passive cooling and thermal comfort.

Text Books:

1. 'Alternative building materials and technologies' by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.
2. 'Non-Conventional Energy Resources' by G. D. Rai, Khanna Publishers.
3. Tom Woolley, Sam Kimmins, Paul Harrison and Rob Harrison "Green Building Handbook" Volume I, Spon Press, 2001.

Reference Books:

1. Mili Majumdar, "Energy-efficient buildings in India" Tata Energy Research Institute, 2002.
2. TERI "Sustainable Building Design Manual- Volume I & II" Tata Energy Research Institute, 2009.

BASIC CONCRETE TECHNOLOGY
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192ST3O03	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To explain the types and properties of cement.
COB 2: To make the students know the properties of materials used for making concrete.
COB 3: To impart knowledge on setting and hardening characteristics of concretes.
COB 4: To teach the basic concepts of various types of special concrete.

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

CO 1: Explain the properties and tests on cement.
CO 2: Classify the different types of aggregates.
CO 3: Outline the mixing of Fresh concrete.
CO 4: Interpret the various tests on workability of Fresh concrete.
CO 5: Demonstrate the behavior of hardened concrete.
CO 6: Illustrate various types of Special Concrete

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO 1 (K 5)	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	2	1	-	-	-	-	-
CO2 (K2)	-	1	-	2	2	1	-	-	-	-	-
CO3 (K3)	1	2	1	3	3	2	-	-	-	-	-
CO4 (K4)	2	3	2	3	3	3	-	-	-	-	-
CO5 (K2)	-	1	-	2	2	1	-	-	-	-	-

UNIT-I:
Cement:
Cement- Chemical Composition – Hydration, setting and fineness of cement- Manufacture of cements. Various types of cement and their properties. Various field and laboratory tests for Cement.

UNIT-II:
Aggregates:
Classification of aggregate – Particle shape & texture –Bond, strength & other mechanical properties of aggregates – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate –Bulking of sand — Sieve analysis – Fineness modulus. Quality of mixing water.

UNIT-III:
Fresh Concrete:

Steps in Manufacture of Concrete–proportion, mixing, placing, compaction, finishing, curing - Properties of fresh concrete-Workability – Factors affecting work ability – Measurement of workability by different tests – Segregation &bleeding.

UNIT-IV:
Hardened Concrete:
Water / Cement ratio – Abram's Law –Gel space ratio Maturity concept– Strength in tension & compression Factors affecting strength – Curing, Testing of Hardened Concrete: Compression tests – Tension tests – Flexure tests –Splitting tests.

UNIT-V:
Special Concretes:
Ready mixed concrete, Shotcrete -Light weight aggregate concrete – Cellular concrete – No-fines concrete, High density concrete, Fibre reinforced concrete – Polymer concrete –High performance concrete – Self consolidating concrete, self healing concrete.

Text Book:
1. Concrete Technology by M. S. Shetty; S. Chand & Company (Pvt.) Ltd., New Delhi, 2006.
2. Properties of Concrete by A. M. Neville; Published by Dorling Kindersley (India) Pvt. Ltd. Licensees of Pearson Education in south Asia, New Delhi, 2002.

Reference Books:
1. Concrete Technology by M. L. Gambhir; Tata Mc Graw – Hill Publishing Company Ltd., New Delhi, 2017**.**
2. Concrete Technology by A.R. Santha kumar; Oxford University press-New Delhi,2006.

Web Links:
1. http:/nptel.ac.in/courses/105102012
2. http://www.engineeringcivil.com/theory/concrete-engineering/
3. https://theconstructor.org/concrete

BASIC FOUNDATION ENGINEERING
(Open Elective)

III Semester	L	T	P	C
Course Code: 192ST3O04	3	0	0	3

Course Objectives:

COB 1: To make students understand about the types of traditional and contemporary foundations.
COB 2: To introduce the index and engineering properties of soils for foundation analysis**.**
COB 3: To imbibe the knowledge on shear strength of soils**.**
COB 4: To induce the principles of design and analysis of shallow foundations.
COB 5: To help students design the deep foundations for heavy structures.

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

CO 1: Recognize the types of available foundations for different structures.
CO 2: Classify the given soil based on index and engineering properties.
CO 3: Interpret the shear strength of cohesive and cohesionless soils.
CO 4: Analyse a shallow foundation for a given soil condition and loading.
CO 5: Analyse a deep foundation for a given loading and soil conditions.

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 (K1)	1	-	-	-	-	-	-	-	-	-	-
CO2 (K2)	1	3	-	2	2	-	-	-	-	-	-
CO3 (K2)	1	2	2	3	1	-	-	-	-	-	-
CO4 (K4)	-	3	3	3	3	1	-	-	-	-	-
CO5 (K4)	-	3	3	3	2	1	-	-	-	-	-

UNIT-I:
Introduction to Foundation Engineering:
Introduction to types of foundations-shallow and deep foundations- suitability of types of foundations-contemporary foundations**.**

UNIT-II:
Soil Properties:
Soil formation —Laboratory tests for soil properties –Relative density. Grain size analysis – Sieve and Hydrometer methods – consistency limits and indices – Various Types of soil Classifications – Unified soil classification– Engineering properties of soils- Definitions.

UNIT–III:
Shear Strength of Soils:
Strength of soils- cohesive and cohesionless soils-tests for shear strength of soils-principal stresses and strains

UNIT-IV:

Design of Shallow Foundations:

Types of foundations and factors to be considered in their location – Bearing capacity – factors influencing bearing capacity – analytical methods to determine bearing capacity – Terzaghi's theory –IS Methods.

UNIT-V:

Design of Deep Foundations:

Types of piles and caissons – Load carrying capacity of piles and caissons based on static formulae – Dynamic pile formulae– Pile and caisson capacity based on empirical relations –Pile load tests – Load carrying capacity of pile groups in sands and clays – Settlement of pile groups.

Text Books:

1. Basic and Applied Soil Mechanics, Gopal Ranjan and A.S.R. Rao, New Age International Publishers, 2007.
2. A Text book of Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers & Distributors, 2011.
3. Principles of Foundation Engineering, Das B.M., 6th Edition (Indian Edition), 2011.

Reference Books:

1. A Text book of Soil Mechanics and Foundations B.C.Punmia, Laxmi Publications, 2005.
2. Foundation Analysis & Design by Bowles & J.E, McGraw- Hill, 1995.

Web Links:

1. http://nptel.ac.in/courses/105103097/
2. http://nptel.ac.in/courses/105101084/
3. https://easyengineering.net/geotechnical-engineering-soil-mechanics/

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RENEWABLE ENERGY TECHNOLOGIES
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192PD3O01	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To enable the students understand basic principles of renewable energy sources.
COB 2: To help the students learn about the principle of induction generators.
COB 3: To help the students understand knowledge of Wind Power Plants.
COB4: To enable the students study interconnection of renewable and Photovoltaic Power Plants.
COB 5: To enable the students understand fuel cell systems for power generation.

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

CO 1: Identify alternate energy sources.
CO 2: Analyze and design induction generator for power generation from wind.
CO 3: Analyze different wind power plants.
CO 4: Design MPPT controller for solar power utilization.
CO 5: Illustrate the basic operation of fuel cells.

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)	1		-	2		-	-	-	-	-	2
CO2 (K2)	-		-		-	-	-	-	-	3	-
CO3 (K4)	2	3	3	3		-	-	-	2	-	-
CO4 (K5)	3		-		2	-	-	-	-	-	-
CO5 (K3)	1	2	-	-	-	-	-	-	-	-	-

UNIT–I:
Introduction:
Renewable Sources of Energy; Distributed Generation; Renewable Energy Economics - Calculation of Electricity Generation Costs; Demand-Side Management Options; Supply-Side Management Options; Control of renewable energy based power Systems

UNIT–II:
Induction Generators:
Principles of Operation; Representation of Steady-State Operation; Power and Losses Generated - Self-Excited Induction Generator; Magnetizing Curves and Self-Excitation – Mathematical Description of the Self-Excitation Process; Interconnected and Stand-alone operation - Speed and Voltage Control.

UNIT–III:

Wind Power Plants:

Site Selection; Evaluation of Wind Intensity; Topography; Purpose of the Energy Generation- General Classification of Wind Turbines; Rotor Turbines; Multiple-Blade Turbines; Drag Turbines; Lifting Turbines - Generators and Speed Control Used in Wind Power Energy; Analysis of Small wind energy conversion system.

UNIT–IV:

Photovoltaic Power Plants:

Solar Energy; Generation of Electricity by Photovoltaic Effect; Dependence of a PV Cell on Temperature and irradiance input-output Characteristics - Equivalent Models and Parameters for Photovoltaic Panels; MPPT schemes: P&O, INC, effect of partial shaded condition. Applications of Photovoltaic Solar Energy-Economical Analysis of Solar Energy

UNIT–V:

Fuel Cells:

The Fuel Cell; Low- and High-Temperature Fuel Cells; Commercial and Manufacturing Issues - Constructional Features of Proton Exchange-Membrane Fuel Cells; Reformers; Electrolyzer Systems; Advantages and Disadvantages of Fuel Cells - Fuel Cell Equivalent Circuit; Practical Determination of the Equivalent Model Parameters; Aspects of Hydrogen for storage

Text Books:

1. Felix A. Farret, M. Godoy Simo` es, Integration of Alternative Sources of Energy, John Wiley & Sons, 2006.
2. Remus Teodorescu, Marco Liserre, Pedro Rodríguez, Grid Converters for Photovoltaic and Wind Power Systems, John Wiley & Sons, 2011.

Reference Books:

1. Gilbert M. Masters, Renewable and Efficient Electric Power Systems, John Wiley & Sons, 2004.
2. Renewable Energy Resources, John Twidell and Tony Weir, E&F. N. Spon.
3. Renewable Energy Resources Basic Principles and Applications, G.N. Tiwari and M.K.Ghosal, Narosa.
4. Solar Heating and Cooling, Kreith & Kreider, CRC press.
5. Wind Energy Hand book, Tony Burton, David Sharpe, Nick Jenkins and Ervin Bossanyi, Wiley.

Web Links:

1. https://en.wikipedia.org/wiki/Renewable_energy
2. http://www.renewableenergyworld.com/index/tech.html
3. http://nptel.ac.in/courses/108105058/

HYBRID ELECTRIC VEHICLES
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192PD3O02	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To enable the students learn the operation of Phase Controlled Converters based DC drives in four quadrants.
COB 2: To help the students learn the modeling and simulation concepts ofAC-DC converters fed drive components.
COB 3: To make the students understand the operation of DC-DC converter fed DC drives
COB 4: To facilitate the students understand the operation of closed loop control based DC-DC converters fed DC drives.
COB 5: To make the students understand Design various power electronic converters to control the DC motors.

Course Outcomes:
At the end of this course, the student will be able to:

CO 1: Illustrate the performance characteristics of converter fed DC drives.
CO 2: Analyze the two quadrants and four quadrant controls of DC motor drives.
CO 3: Develop the mathematical models of DC drive components.
CO 4: Analyze the four quadrant and closed loop control of DC-DC converter fed DC drive.
CO 5: Propose various controlling techniques of DC drives for industrial applications.
CO 6: Design various power electronic converters to control the DC motors.

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 (K4)	2	3	3	3	1	-	-	1	2	-	-
CO5 (K6)	3	3	3	3	3	-	-	3	3	3	-
CO6 (K6)	3	3	3	3	3	-	-	3	3	3	-

UNIT–I:
Introduction:
History of hybrid vehicles, architectures of HEVs, series and parallel HEVs, complex HEVs.

UNIT–II:
Hybridization of Automobile:
Fundamentals of vehicle, components of conventional vehicle and propulsion load; Drive cycles and drive terrain; Concept of electric vehicle and hybrid electric vehicle;

Plug-in hybrid vehicle, constituents of PHEV, comparison of HEV and PHEV; Fuel Cell vehicles and its constituents.

UNIT–III:
Plug-in Hybrid Electric Vehicle:
PHEVs and EREVs blended PHEVs, PHEV Architectures, equivalent electric range of blended PHEVs; Fuel economy of PHEVs, power management of PHEVs, end-of-life battery for electric power grid support, vehicle to grid technology, PHEV battery charging.

UNIT–IV:
Power Electronics in HEVs:
Rectifiers used in HEVs, voltage ripples; Buck converter used in HEVs, non-isolated bidirectional DC-DC converter, regenerative braking, voltage source inverter, current source inverter, isolated bidirectional DCDC converter, PWM rectifier in HEVs, EV and PHEV battery chargers.

UNIT–V:
Battery and Storage Systems:
Energy Storage Parameters; Lead–Acid Batteries; Ultra capacitors; Flywheels - Superconducting Magnetic Storage System; Pumped Hydroelectric Energy Storage; Compressed Air Energy Storage - Storage Heat; Energy Storage as an Economic Resource.

Text Books

1. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 2014.
2. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.

ENERGY AUDIT AND CONSERVATION MANAGEMENT
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192PD3O03	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To understand energy efficiency, scope, conservation and technologies.
COB 2: To design energy efficient lighting systems.
COB 3: To estimate/calculate power factor of systems and propose suitable compensation techniques.
COB 4: To understand energy conservation in HVAC systems.
COB 5: To calculate life cycle costing analysis and return on investment on energy efficient technologies.

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

CO 1: Explain energy efficiency, conservation and various technologies.
CO 2: Design energy efficient lighting systems.
CO 3: Calculate power factor of systems and propose suitable compensation techniques.
CO 4: Explain energy conservation in HVAC systems.
CO 5: Calculate life cycle costing analysis and return on investment on energy efficient technologies.

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	2	3	2	3	3	2
CO2 (K2)	-	-	-	-	2	2	3	-	-	3	-
CO3 (K2)	2	-	-	-	-	-	3	-	-	-	-
CO4 (K3)	-	-	-	-	-	-	-	-	-	-	-
CO5 (K4)	3	3	-	2	3	-	3	-	-	1	-

UNIT-I:
Basic Principles Of Energy Audit And Management:
Energy audit – Definitions – Concept – Types of audit – Energy index – Cost index – Pie charts –Sankey diagrams – Load profiles – Energy conservation schemes and energy saving potential – Numerical problems – Principles of energy management – Initiating, planning, controlling, promoting, monitoring, reporting – Energy manager – Qualities and functions –Language – Questionnaire – Check list for top management.

UN1T-II:
Lighting:
Modification of existing systems – Replacement of existing systems – Priorities**:** Definition of terms and units – Luminous efficiency – Polar curve – Calculation of illumination level –Illumination of inclined surface to beam – Luminance or brightness – Types of lamps –Types of lighting – Electric lighting fittings (luminaries) – Flood lighting – White light LED and conducting Polymers – Energy conservation measures.

UNIT-III:

Power Factor and energy instruments:

Power factor – Methods of improvement – Location of capacitors – Power factor with nonlinear loads – Effect of harmonics on Power factor – Numerical problems. Energy Instruments – Watt–hour meter – Data loggers – Thermocouples – Pyrometers – Lux meters– Tong testers – Power analyzer.

UNIT-IV:

Space Heating and Ventilation:

Ventilation – Air–Conditioning (HVAC) and Water Heating**:** Introduction – Heating of buildings – Transfer of Heat–Space heating methods – Ventilation and air–conditioning –Insulation–Cooling load – Electric water heating systems – Energy conservation methods.

UNIT-V:

Economic Aspects and Financial Analysis:

Understanding energy cost - Economics Analysis – Depreciation Methods – Time value of money – Rate of return – Present worth method – Replacement analysis – Life cycle costing analysis – Energy efficient motors (basic concepts) – Economics of energy efficient motors and systems.

Computation of Economic Aspects:

Need of investment, appraisal and criteria - Calculation of simple payback period– Return on investment – Net present value – Internal rate of return – numerical examples – Power factor correction – Lighting – Applications of life cycle costing analysis.

Text Books:

1. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi.
2. Energy efficient electric motors by John.C. Andreas, Marcel Dekker Inc Ltd– 2nd edition, 1995.

Reference Books:

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012
2. Energy management by Paul o' Callaghan, Mc–Graw Hill Book company– 1stedition, 1998.
2. Energy management hand book by W.C.Turner, John wiley and sons.
3. Energy management and conservation –k v Sharma and P.Venkataseshaiah-I K
4. International Publishing House pvt.ltd,2011.
5. Hand Book of Energy Audit by Sonal Desai- Tata McGraw hill.

Web Links:

1. https://nptel.ac.in/courses/108106022/
2. https://nptel.ac.in/courses/112105221/
3. https://onlinecourses.nptel.ac.in/noc17_mm17/preview

NEURAL NETWORKS AND FUZZY LOGIC
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192PD3O04	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To make the students learn artificial neuron models.
COB 2: To facilitate the students to study various learning methods of ANN.
COB 3: To utilize different algorithms of ANN.
COB 4: To enable students to distinguish between Classical and Fuzzy Sets.
COB 5: To describe different modules of Fuzzy Controller.
COB 6: To provide adequate knowledge of application of fuzzy logic control to real time systems.

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

CO 1: Demonstrate different models of artificial neuron.
CO 2: Identify various learning methods of ANN.
CO 3: Analyze the various feed forward neural networks and Hopfield Network.
CO 4: Compare and Contrast Classical and Fuzzy sets.
CO 5: Utilize different modules of Fuzzy Logic Controller for rule base and decision making Systems.
CO 6: Analyze the application of fuzzy logic control to real time systems.

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	--	--	--	--	--	--
CO2 (K3)	3	2	1	1	3	--	--	--	--	--	--
CO3 (K4)	3	3	2	2	2	--	--	--	--	--	--
CO4 (K2)	2	1	--	--	2	--	--	--	--	--	--
CO5 (K3)	3	2	1	1	3	--	--	--	--	--	--
CO6 (K4)	3	3	2	2	2	--	--	--	--	--	--

UNIT–I:
Introduction to Neural Networks:
Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential, Applications of ANN.

UNIT–II:
Essentials of Artificial Neural Networks
Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

UNIT–III:

Multilayer feed forward Neural Networks:

Credit Assignment Problem, Generalized Delta Rule, Derivation of Back propagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements, Radial Basis Function (RBF) Neural Network – Kohonen Self Organising feature Map (KSOM).

Associative Memories: Bidirectional Associative Memories (BAM)-Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm

UNIT-IV:

Classical & Fuzzy Sets:

Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT–V:

Fuzzy Logic Modules:

Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

Applications

Neural network applications: Process identification, control, fault diagnosis and load forecasting.

Fuzzy logic applications: Load frequency control and Fuzzy classification.

Text Books:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications, Rajasekharan and Rai – PHI Publication.
2. Introduction to Neural Networks using MATLAB 6.0 - S.N.Sivanandam, S.Sumathi, S.N.Deepa, TMH, 2006.

Reference Books:

1. Neural Networks – James A Freeman and Davis Skapura, Pearson Education, 2002.
2. Neural Networks – Simon Hakins, Pearson Education.
3. Neural Engineering by C.Eliasmith and CH.Anderson, PHI.
4. Neural Networks and Fuzzy Logic System by Bart Kosko.

Web Links:

1. https://www.coursera.org/browse/computer-science
2. https://www.tutorialspoint.com/artificial_neural_network/
3. https://in.udacity.com/school-of-ai

INDUSTRIAL SAFETY
(Open Elective)

III Semester	L	T	P	C
Course Code: 192PD3O05	3	0	0	3

Course Educational Objectives:

COB 1: To learn safety aspects of any industrial area.
COB 2: To learn fundamentals and types of maintenance engineering.
COB 3: To learn causes and effects of wear and Corrosion and their prevention.
COB 4: To learn identification of faults and their repair.
COB 5: To learn preventive maintenance- periodic an preventive-maintenance of industrial systems.

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

CO 1: Understand the general industrial requirements like lighting, cleanliness prevention from hazards and accidents.
CO 2: Analyze maintenance requirements of the industry and cost associated.
CO 3: Analyze wear and corrosion aspects of the industry and their prevention.
CO 4: Identify the faults prone areas and their repair and periodic maintenance.

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 (K4)	2	-	-	--	-	-	-	-	-	-	-
CO2 (K2)	-	1	-	-	-	-	-	-	-	-	-
CO3 (K2)	-	1	-	-	-	-	-	-	-	-	-
CO4 (K4)	2	-	-	-	-	-	-	-	-	-	-
CO5 (K4)	2	-	-	-	-	-	-	-	-	-	-

UNIT-I:
Industrial Safety:
Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT-II:
Fundamentals of Maintenance Engineering:
Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III:

Wear and Corrosion and Their Prevention:

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT-IV:

Fault Tracing:

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT-V:

Periodic and Preventive Maintenance:

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.

Reference Books:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

COMPOSITE MATERIALS

(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192PD3O06	**3**	**0**	**0**	**3**

Course Educational Objectives:

COB 1: To learn characteristics of composite materials and know effects of reinforcement
COB 2: To learn application of different fibers, understand rules of mixtures
COB 3: To learn manufacturing of ceramic matrix, carbon matrix and applications
COB 4: To learn preparation of moulding compounds, properties and applications
COB 5: To learn strength and failure criteria

Course Outcomes:

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

CO 1: Understand characteristics and advantages of composite materials
CO 2: Acquire knowledge of reinforcement, glass fiber, etc.
CO 3: Identify the usage of metal matrix composites
CO 4: Understand manufacturing of polymer matrix composites
CO 5: Identify different types of failures.

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 (K4)	2	-	-	--	-	-	-	-	-	-	-
CO2 (K2)	-	1	-	-	-	-	-	-	-	-	-
CO3 (K2)	-	1	-	-	-	-	-	-	-	-	-
CO4 (K4)	2	-	-	-	-	-	-	-	-	-	-
CO5 (K4)	2	-	-	-	-	-	-	-	-	-	-

UNIT–I:

Introduction:

Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT–II:

Reinforcements:

Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behaviour of composites: Rule of mixtures, Inverse rule of mixtures. Isos train and Iso stress conditions.

UNIT–III:

Manufacturing of Metal Matrix Composites:

Casting – Solid State diffusion technique, Cladding – Hot iso static pressing, Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV:

Manufacturing of Polymer Matrix Composites:

Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT–V:

Strength:

Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hydrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Text Books:

1. Material Science and Technology – Vol 13 – Composites by R.W. Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Bala Subramanian, John Wiley & Sons, NY, Indian edition, 2007.

Reference Books:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

ENERGY SYSTEMS
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192TE3O01	**3**	**0**	**0**	**3**

Course Objectives:

COB1: To impart the principles of energy systems and cycles & combustion systems.
COB2: To analyze various energy storage devices and selection in techno-economic scenario.
COB3: To evaluate energy conservation schemes using measurement techniques.

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

CO 1: Explain the working principle of various energy systems.
CO 2: Calculate the availability analysis of the energy systems and cycles.
CO 3: Explain the design and working principles of combustion systems.
CO 4: Explain the thermal energy auditing technologies and procedures.
CO 5: Analyse various types of energy storage devices and perform the selection based on techno-economic view point.
CO 6: Explain various measurement techniques useful for the evaluation of Energy Conservation Schemes.

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	-	-	-	-	-
CO2 (K3)	2	1	2	-	-	1	-	-	-	-	-
CO3 (K2)	2	1	1	-	-	1	-	-	-	-	-
CO4 (K3)	2	1	1	-	-	1	-	-	-	-	-
CO5 (K4)	2	1	1	1	-	1	-	-	1	1	-
CO6 (K2)	2	-	1	-	-	1	-	-	1	1	-

UNIT-I:
Energy (Re) Sources:
Commercial energy, fossil fuels, solar energy, wind energy, solar pv and thermal systems, Tidal Energy. Wave Energy, Ocean Thermal Energy Conversion (OTEC)-Hydrogen Production and Storage, Fuel cell , Environmental consequences of Fossil fuel use, Importance of renewable sources of energy, Sustainable Design and development, Types of RE sources, Limitations of RE sources, Present Indian and international energy scenario of conventional and RE sources.

UNIT-II:
Thermodynamic Analysis of Energy Systems:
Thermodynamic potentials. Maxwell relations. Generalized relations for changes in entropy - internal energy and enthalpy - Cp and CV. Clausius Clay per on equation, Joule – Thomson coefficient. Bridgeman tables for thermodynamic relations. Combustion in IC Engines and Gas turbines. Knocking & Detonation and control. Design principles of combustion chambers for IC Engines and Gas turbine

UNIT-III:

Energy Conservation in Thermal Systems:

Indian Energy Scenario – Basics of Energy and its various forms - Primary / Secondary Energy Sources – Energy Conservation – Energy Intensive Industries – Barriers - EC Act 2003 : Salient Features - Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, State Designated Agencies - Integrated energy policy - National action plan on climate change.

UNIT-IV:

Energy Storage Systems:

Energy Storage Technologies - Mechanical energy, Electrical energy, Chemical energy, Thermal energy. Flywheel, Super capacitors, Principles & Methods – Applications, Compressed air Energy storage, Concept of Hybrid Storage – Applications.

UNIT-V:

Measurements in Energy Systems:

Basic Electrical measurements, Transducers and its types, Signal conditioning and processing - Measurement of temperature, pressure, velocity, flow rate, thermo-physical and transport properties of solids liquids and gases, Radiation properties of surfaces, Vibration and noise - Computer assisted data acquisition, Data manipulation and data presentation.

Text Books:

1. Bejan A., “Advanced Engineering Thermodynamics”, John Wiley and Sons, 1988.
2. Cohen H., Rogers G.F.C. and Saravan motto H.I.H., “Gas Turbine Theory”, John Wiley, 5th Edition, 2001.

References:

1. Bejan A., “Advanced Engineering Thermodynamics”, John Wiley and Sons, 1988.
2. Cohen H., Rogers G.F.C. and Saravan motto H.I.H., “Gas Turbine Theory”, John Wiley, 5th Edition, 2001.
3. Diamant R.M.E., “Total Energy”, Pergamon, Oxford, 1970.
4. Hamies “Energy Auditing and Conservation; Methods Measurements, Management and Case study”, Hemisphere, Washington, 1980.
5. Alan S Morris and Reza Langari, “Measurements and Instrumentation – Theory and Application”, Elsevier Inc, 2012.
6. Bolten. W, “Industrial Control and Instrumentation”, University Press, 2004.
7. Archie W. Culp, “Principles of Energy Conversion”, McGraw-Hill Inc., Singapore, 1991.
8. Barclay F.J., “Fuel Cells, Engines and Hydrogen”, Wiley, 2009.

FUELS AND COMBUSTION
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192TE3O02	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To impart knowledge on various fuels**.**
COB 2: To provide the theory and working principles of various combustions processes**.**
COB 3: To impart knowledge on thermodynamics of combustion**.**
COB 4: To induce the knowledge on flames**.**
COB 5: To discuss various environmental considerations.

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

CO 1: Explain detailed classification of solid fuels and their conversion process.
CO 2: Differentiate various rate of reactions.
CO 3: Evaluate thermodynamics related to combustion process.
CO 4: Explain the parameters involved in Flame propagation.
CO 5: Identify the various sources of air pollution.

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	1	-	-	-	-	-	-	-	-
CO2 (K2)	1	1	1	-	-	-	-	-	-	-	-
CO3 (K5)	3	2	2	2	-	-	-	-	1	-	1
CO4 (K3)	1	1	1	1	-	-	-	-	-	-	-
CO5 (K2)	1	1	1	1	-	-	-	-	-	-	-

UNIT-I:
Fuels:
Detailed classification – Conventional and Unconventional Solid, Liquid, gaseous fuels and nuclear fuels – Origin of Coal – Analysis of coal.
Coal – Carborisation, Gasification and liquification – Lignite: petroleum based fuels – problems associated with very low calorific value gases: Coal Gas – Blast Furnace Gas Alcohols and Biogas.

UNIT–II:
Principles of Combustion:
Chemical composition – Flue gas anlaysis – dew point of products – Combustion stoichiometry. Chemical kinetics – Rate of reaction – Reaction order – Molecularity – Zeroth, first, second and third order reactions - complex reactions – chain reactions. Theories of reaction Kinetics – General oxidation behavior of HC's

UNIT-III:
Thermodynamics of Combustion:
Enthalpy of formation – Heating value of fuel - Adiabatic flame Temperature – Equilibrium composition of gaseous mixtures.

UNIT–IV:

Laminar and Turbulent Flames Propagation and Structure:

Flame stability – Burning velocity of fuels – Measurement of burning velocity – factors affecting the burning velocity. Combustion of fuel, droplets and sprays – Combustion systems – Pulverized fuel furnaces – fixed Entrained and Fluidized Bed Systems.

UNIT-V:

Environmental Considerations:

Air pollution – Effects on Environment, Human Health etc. Principal pollutants – Legislative Measures – Methods of Emission control

Text Books:

1. Roger A strehlow "**Combustion Fundamentals**" Mc Graw Hill, 2nd Edition,1984.
2. Sharma and Chander Mohan **"Fuels and combustion"** – Tata Mc Graw Hill, 3rd Edition,1987
3. 1. Shaha A.K. **"Combustion Engineering and Fuel Technology"** Oxford and IBH.

Reference Books:

1. Kanneth K.Kuo, **"Principles of Combustion**" Wiley and Sons. 2nd Edition, 2014.
2. Sarkar "**Combustion"** – Mc. Graw Hill. 3rd Edition, 1988.
3. Stephen R. Turns, "**An Introduction to Combustion"** Mc. Graw Hill International Edition, 3rd Edition, 2011.
4. Gary L. Berman & Kenneth W. Ragland, "**Combustion Engineering"** Mc. Graw Hill International Edition, 2nd Edition,2011.
5. I. Glassman "**Combustion"** 4th Edition, 2008.

Web Links:

1. http://gchem.cm.utexas.edu/echem/index.php
2. www.dtic.mil/dtic/tr/fulltext/u2/627658.pdf
3. http://nptel.ac.in/courses/103105110/:
4. https://www2.warwick.ac.uk/fac/sci/eng/eso/modules/year4/es4e4/:

GREEN ENGINEERING TECHNOLOGY
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192TE3O03	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To highlight the significance of alternative sources of energy, green energy systems.
COB 2: To provide the theory and working principles of probable sources of renewable and green energy system that are environmental friendly.
COB3: To impart knowledge of bio mass, geothermal energy and ocean energy**.**
COB4: To induce the knowledge on electrical systems**.**
COB5: To discuss the working energy efficient systems**.**

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

CO:1: Distinguish the various solar energy collection methods and measuring instruments.
CO2: Explain the different methods of solar energy storage and their applications.
CO3: Illustrate the various types of wind mills and performance characteristics.
CO4: Explain the principle of Biomass production, Geothermal energy sources and Ocean thermal energy conversion.
CO5: Illustrate the various types of electrical systems and mechanical systems.
CO6: Compare the various energy efficient process.

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(K4)	3	1	-	3	-	-	-	-	3	2	-
CO2(K3)	3	3	1	3	-	-	1	-	3	3	-
CO3(K3)	3	3	2	1	-	-	1	-	2	2	-
CO4(K3)	3	3	2	1	-	-	1	-	2	2	-
CO5(K3)	1	2	1	1	-	-	1	-	1	1	-
CO6(K4)	2	1	1	1	-	-	2	-	2	2	-

UNIT-I:
Introduction: Solar Radiation:
Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells, I-V characteristics
Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT –II:

Solar Energy Storage and Applications:

Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

UNIT-III:

Bio-Mass:

Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

Ocean Energy: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT –IV:

Electrical Systems:

Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management.

MECHANICAL Systems: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, Environmental friendly and Energy efficient compressors and pumps.

UNIT-V:

Energy Efficient Processes:

Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.

Green Buildings: Definition, features and benefits. Sustainable site selection and planning of building for maximum comfort. Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste.

Text Books:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/ TMH.
2. Non-Conventional Energy Resources/ Khan B.H/ Tata McGraw Hill, New Delhi, 2006.
3. Green Manufacturing Processes and Systems, Edited / J. Paulo Davim/Springer 2013.

Reference Books:

1. Alternative Building Materials and Technologies / K.S Jagadeesh, B.V Venkata Rama Reddy and K.S. Nanjunda Rao/New age international.
2. Principles of Solar Engineering / D.Yogi Goswami, Frank Krieth & John F Kreider / Taylor &Francis.
3. Non-Conventional Energy / Ashok V Desai /New Age International (P) Ltd.
4. Renewable Energy Technologies /Ramesh & Kumar /Narosa.
5. Non-conventional Energy Source/ G.D Roy/Standard Publishers.
6. Renewable Energy Resources-2 Edition/ J.Twidell and T. Weir/ BSP Books Pvt. Ltd.
7. Fuel Cell Technology –Hand Book / Gregor Hoogers / BSP Books Pvt. Ltd. nd.

Web Links:

1. https://onlinecourses.nptel.ac.in/noc17_me33
2. https://nptel.ac.in/courses/105107176/20
3. https://cnim.com/sites/default/files/media/Brochures/CNIM-energy-ef
4. Ficiencysystems.pdf
5. https://www.beeindia.gov.in/sites/default/files/3Ch10.pdf

IC ENGINES
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192TE3O04	**3**	**0**	**0**	**3**

Course Objectives:

COB1: Understanding the IC engine with a perspective of their fundamentals.
COB2: Analysing the engine performance and combustion characteristics.
COB3: Understanding the engine emission formation and its control.
COB 4: Understanding the electrical vehicles and their accessories.

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

CO1: Predict the engine combustion characteristics.
CO2: Evaluate engine performance.
CO3: Interpret the formation of engine emission and their control strategies.
CO4: Distinguish the usage of different alternative fuels and their compatibility with fossil fuels
CO5: Explain the constructional and working principles of electrical vehicle and their accessories.

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 (K5)	3	3	2	3	1	3	-	-	-	-	-
CO2 (K5)	3	3	2	3	1	3	-	-	-	-	-
CO3 (K5)	3	3	2	3	1	3	-	-	-	-	-
CO4 (K4)	3	3	3	3	1	3	-	-	-	-	-
CO5 (K2)	1	2	1	1	1	3	-	-	-	-	-

UNIT-I:

Two-stroke engines:

Definition of parameters-Scavenging Efficiency, Delivery ratio and trapping Efficiency, Theoretical Scavenging Processes-Practical Scavenging Systems-Kadenacy effect-Numerical problems on 2-stroke cycle engines.

Spark Ignition Engines: Flame Propagation- Combustion phenomena (Normal and Abnormal), Factors affecting, Detonation, Ignition quality, HUCR-Carburetion and fuel injection systems for SI Engines.

Compression Ignition Engines: Advantages of CI engines-Importance of air motion and Compression Ratio, Mixture Preparation inside the CC. Normal and abnormal combustion - Ignition Quality-Cetane number-Characteristics of a Good Combustion Chamber-Classification of Combustion Chambers(DI and IDI).Description of Fuel injection Systems -Individual, Unit and Common Rail (CRDI),Fuel Injectors-Nozzle types, Electronic Control Unit(ECU)-Numerical problems on fuel injection.

UNIT-II:

Supercharging of IC Engines:

Need of Supercharging and advantages, Configurations of Supercharging-Numerical problems on turbo charging.

Pollutant emissions from IC Engines: Introduction to clean air, Pollutants from SI and CI-Engines: Carbon monoxide, UBHCs, Oxides of nitrogen (NO-NOX) and Particulate Matter. Mechanism of formation of pollutants, Factors affecting pollutant formation. Measurement of engine emissions-instrumentation, Pollution Control Strategies, Emission norms-EURO and Bharat stage norms.

UNIT-III:

Performance of IC Engines:

Classification of engine performance parameters-Measurement of brake power indicated power and friction power. Factors affecting performance, Heat loss, Air-fuel ratio, Pumping loss, Energy Balance: Pi and Sankey diagrams Numerical problems.

Alternate Fuels: Need for Alternate fuels, Desirable Characteristics of good Alternate Fuel-Liquid and Gaseous fuels for SI and CI Engines, Kerosene, LPG, Alcohols, Bio-fuels, Natural gas, Hydrogen and use of these fuels in engines.

UNIT-IV:

Electric Vehicles:

Introduction: Limitations of IC Engines as prime mover, History of EVs, EV system, components of EV-DC and AC electric machines: Introduction and basic structure-Electric vehicle drive train-advantages and limitations, Permanent magnet and switched reluctance motors-EV motor sizing: Initial acceleration, rated vehicle velocity, Maximum velocity and maximum gradeability.

Hybrid Vehicle: Configurations of hybrids, advantages and limitations-Hybrid drive trains, sizing of components Initial acceleration, rated vehicle velocity, Maximum velocity and maximum gradeability-Hydrogen: Production-Hydrogen storage systems-reformers.

UNIT-V:

Batteries:

Battery: lead-acid battery, cell discharge and charge operation, construction, advantages of lead- acid battery- Battery parameters: battery capacity, discharge rate, state of charge, state of discharge, depth of discharge, Technical characteristics-Rag one plots.

Fuel Cell Vehicles: Fuel cells: Introduction-Fuel cell characteristics, Thermodynamics of fuel cells-Fuel cell types: emphasis on PEM fuel cell.

Text Books:

1. J.B. Heywood Internal Combustion Engine Fundamentals, McGraw Hill Co.1988.
2. W.W. Pulkrabek Engineering Fundamentals of IC Engine, PHI Pvt. Ltd 2002.
3. Seth Leitman and Bob Brant *Build your own electric vehicle* McGraw Hill Co.2009.
4. F.Barbir *PEM Fuel Cells-Theory and Practice* Elsevier Academic Press-2.

Web Links:

1. https://www.britannica.com/technology/fuel-cell
2. https://www.ctc-n.org/technologies/hybrid-electric-vehicles
3. https://www.evgo.com/why-evs/types-of-electric-vehicles/
4. https://circuitdigest.com/article/different-types-of-motors-used-in-electric-vehicles -ev
5. https://www.thedrive.com/tech/17505/the-secrets-of-electric-cars-and-their-motors -its-not-all-about-the-battery-folks

AUTOMOTIVE TECHNOLOGY
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code:192TE3O05	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To import the knowledge about vehicles chassis and constructional aspects of an automobile.
COB 2: To compare sprung and un sprung mass in their constructional and working principles
COB 3: To explain the functional details of various electrical systems of an automobile

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

CO 1: Summarize the vehicle chassis layout and constructional features of vehicle body.
CO 2: Explain the constructional and working principles of sprung masses.
CO 3: Explain the constructional and working principles of un sprung masses.
CO 4: Summarize the functionalities of various electrical systems of a typical automobile.

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(K4)	3	2	1	-	-	-	-	-	1	1	-
CO2(K2)	2	1	1	1	-	-	-	-	-	1	-
CO3(K4)	3	2	1	1	-	-	-	-	-	1	-
CO4(K2)	2	1	1	-	-	1	-	-	1	1	-

UNIT–I:
Chassis and Body:
Classification of vehicle, layout with reference to power plant, steering location and drive, chassis, construction and details (frames, sub-frames, defects in frame, frameless vehicles, vehicle dimensions), details of chassis & body materials, Integrated body construction, BIW type and corresponding design parameters, Vehicle interior system(dash board & seating system), Cosole design, Pillar trims (Type A, B, C), head roofs.

UNIT-II:
Transmission and Driveline:
Clutches, principle, types, Fluid coupling and torque convertors, problems on performance of automobile such as resistance to motion, tractive efforts, engine speed, power and acceleration requirements. Determination of gear box ratios for different vehicle applications, different types of gear boxes, Automatic transmission,

Effect of driving thrust and torque-reaction, Hotchkiss drives, Torque tube drive, radius rods, Propeller shaft, Universal joints, Final drive- different types, two speed rear axle, Rear axle construction: full floating, three quarter floating and semi-floating arrangements, Differential: conventional type & Non-slip type, differential locks.

UNIT-III:
Front Axle and Steering:
Front axle types, rigid axle and split axle, constructional details, materials, front wheel geometry viz., camber, castor, kingpin inclination, toe-in and toe out, Wheel alignment and balancing, Condition for true rolling motion of road wheels during steering. Steering geometry. Ackermann and Davis steering. Construction details of steering linkages. Different types of steering gear box. Steering linkages layout for conventional and independent suspensions. Turning radius, instantaneous centre, wheel wobble and shimmy. Over-steer and under-steer. Power and power assisted steering.

UNIT-IV:
Braking and Suspension:
Type of brakes, Principles of shoe brakes. Constructional details –materials, braking torque developed by leading and trailing shoes. Disc brake, drum brake theory, constructional details, advantages, Brake actuating systems. Factors affecting brake performance, Parking & Exhaust brakes, power & power assisted brakes, Antilock Breaking System (ABS). Testing of brakes, thermal Considerations.

Types of suspension, factors influencing ride comfort, types of suspension springs (leaf &coil springs), independent suspension (front and rear). Rubber, pneumatic, hydro-elastic suspension, Shock absorbers, types of wheels, construction of wheel assembly, types of tires and constructional details, Static and rolling properties of pneumatic tires, tubeless tires and aspect ratio of tube tires.

UNIT-V:
Electrical System:
Battery, Charging circuit, Alternator, generator, current – voltage regulator – starting systems, bend ix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator, wiring harness, Trouble shooting.

Text Books:
1. The Motor Vehicle, K. Newton, W. Steeds and T.K. Garret, Butterworth Heinemann, India, 13th Edition.
2. Automobile Engineering**,** Kirpal Singh, Standard Publications,13th Edition.

Reference Books:
1. Automobile Engineering, G.B.S Narang, Khanna Publishers,12th Reprint.
2. Automobile Mechanics, Dr. N. K. Giri, Khanna Publishers, 7th Reprint.
3. Advanced Vehicle Technology, Heinz Heisler, Butterworth Heinemann, New York, 2nd Edition.
4. Automobile Engineering**,** R.P.Sharma, Dhanpat Rai & Sons Publications, Revised Edition.

Web Links:

1. https://www.princeton.edu/~ota/disk1/1995/9514/9514.PDF
2. http://160592857366.free.fr/joe/ebooks/Automative%20engineering%20books/Automotive%20Engineering%20Powertrain,%20Chassis%20System%20and%20Vehicle%20Body.pdf
3. https://www.europa-lehrmittel.de/downloads-leseproben/23018-2/84.pdf

EMBEDDED SYSTEM DESIGN
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192ES3O01	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To impart the knowledge on Embedded system design concepts.
COB 2: To facilitate the students to gain knowledge about the basic functions of embedded system components such as memories, I/O components, Buses.
COB 3: To facilitate the knowledge about hardware and software tools, device drivers for embedded industry
COB 4: To train the students to design systems, test and critically evaluate embedded solutions to real world situations
COB 5: To illustrate the case studies of different processors for approaching to design the real time embedded systems.

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

CO 1: Apply processor based embedded system design concepts to develop an embedded system.
CO 2: Analyze the hardware components, processor performance of an embedded system design.
CO 3: Make use of operating systems and embedded programming languages to develop a real-time system.
CO 4: Utilize modern development tools, CAD tools for integrating software and hardware components in embedded system designs.
CO 5: Develop an embedded system by understanding the various processor architecture case studies along with its applications.

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)	1	2	1	3	-	-	-	-	-	-	-
CO2 (K4)	2	3	2	3	-	-	-	-	-	-	-
CO3 (K3)	1	2	1	3	-	-	-	-	-	-	-
CO4 (K3)	1	2	1	3	3	-	-	-	-	-	-
CO5 (K3)	1	2	1	3	-	-	-	-	-	-	-

UNIT-I:
Introduction to Embedded Systems:
An Embedded System-Definition, Examples, Current Technologies, Integration in system Design, Embedded system design flow, hardware design concepts, software development, processor in an embedded system and other hardware units, introduction to processor based embedded system design concepts.

UNIT-II:
Embedded Hardware:
Embedded hardware building blocks, Embedded Processors–ISA architecture models, Internal processor design, processor performance, Board Memory–ROM,

RAM, Auxiliary Memory, Memory Management of External Memory, Board Memory and performance.

Embedded board Input/output–Serial versus Parallel I/O, interfacing the I/O components, I/O components and performance, Board buses–Bus arbitration and timing, integrating the Bus with other board components, Bus performance.

UNIT-III:
Embedded Software:
Device drivers, Device Drivers for interrupt-Handling, Memory device drivers, On-board bus device drivers, Board I/O drivers, Explanation about above drivers with suitable examples.

Embedded operating systems–Multitasking and process Management, Memory Management, I/O and file system management, OS standards example–POSIX, OS performance guidelines, Board support packages, Middleware and Application Software–Middleware, Middleware examples, Application layer software examples.

UNIT-IV:
Embedded System Design, Development, Implementation and Testing:
Embedded system design and development life cycle model, creating an embedded system architecture, introduction to embedded software development process and tools-Host and Target machines, linking and locating software, getting embedded software into the target system, issues in Hardware-Software design and co-design.

Implementing the design-The main software utility tool, CAD and the hardware, Translation tools, debugging tools, testing on host machine, simulators, Laboratory tools, System Boot-Up.

UNIT-V:
Embedded System Design-Case Studies:
Case studies-Processor design approach of an embedded system–Power PC Processor based and Micro Blaze Processor based Embedded system design on Xilinx platform-Nios II Processor based Embedded system design on Altera platform-Respective Processor architectures should be taken into consideration while designing an Embedded System.

Text Books:

1. Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers, Tammy Noergaard, Elsevier(Singapore) Pvt. Ltd. Publications,2005.
2. Embedded system Design: A Unified Hardware/Software Introduction, Frank Vahid, Tony D. Givargis, John Wily & Sons Inc, 2002.
3. Introduction to Embedded Systems, Shibu K.V, Mc Graw Hill.

Reference Books:

1. Embedded System Design, Peter Marwedel, Science Publishers, 2007.
2. Embedded System Design, Arnold S Burger, CMP.
3. Embedded Systems: Architecture, Programming and Design, Rajkamal, TMH.

Web Links:

1. https://www.tutorialspoint.com/embedded_systems/
2. http://nptel.ac.in/courses/106105159/
3. http://www.nptelvideos.in/2012/11/embedded-systems.html
4. http://www.dauniv.ac.in/Embedded_Sys.php
5. https://sites.google.com/site/embeddedsystemddr/ppt

DIGITAL SYSTEM DESIGN
(Open Elective)

	L	T	P	C
III Semester				
Course Code: 192ES3O02	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To make the students to aware of different algorithms for minimizing the complexity of digital system design.
COB 2: To demonstrate the students about PLA design aspects, IISc & COMPACT algorithms with suitable examples.
COB 3: To impart the knowledge on SM charts, design aspects of ROM, PAL and digital circuit design approach using CPLDs, FPGAs and ASICS.
COB 4: To impart the knowledge about Fault Modelling, Test Patten generation and different methods for fault diagnosis of Combinational circuits.
COB 5: To impart the knowledge about fault diagnosis methods of Sequential circuits.

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

CO 1: Examine CAMP Algorithms for minimizing the complexity of digital system design.
CO 2: Simplify digital circuits using PLA minimization algorithm (IISc algorithm) and PLA folding algorithm.
CO 3: Construct digital circuits using CPLDs, FPGAs and ASICs.
CO 4: Analyze the functionality of combinational circuits using different fault diagnosis & test methods.
CO 5: Analyze the testing aspects and fault diagnosis methods of sequential circuits.

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(K4)	2	3	2	-	-	-	-	-	-	-	-
CO 2(K4)	-	3	-	-	-	-	-	-	-	-	-
CO 3(K3)	1	2	1	3	3	-	-	-	-	-	-
CO 4(K4)	2	3	2	-	-	-	-	-	-	-	-
CO 5(K4)	2	3	2	-	-	-	-	-	-	-	-

UNIT-I:

Minimization Procedures and CAMP Algorithm:

Review on minimization of switching functions using tabular methods, k-map, QM algorithm, CAMP-I algorithm, Phase-I: Determination of Adjacencies, DA, CSC, SSMs and EPCs,, CAMPI algorithm, Phase-II: Passport checking, Determination of SPC, CAMP-II algorithm: Determination of solution cube, Cube based operations, determination of selected cubes are wholly within the given switching function or not, Introduction to cube based algorithms.

UNIT-II:

PLA Design, Minimization and Folding Algorithms:

Introduction to PLDs, basic configurations and advantages of PLDs, PLA-Introduction, Block diagram of PLA, size of PLA, PLA design aspects, PLA minimization algorithm (IISc algorithm), PLA folding algorithm (COMPACT algorithm)-Illustration of algorithms with suitable examples.

UNIT-III:

Design of Large Scale Digital Systems:

Algorithmic state machine charts-Introduction, Derivation of SM Charts, Realization of SM Chart, control implementation, control UNIT design, data processor design, ROM design, PAL design aspects, digital system design approaches using CPLDs, FPGAs and ASICs.

UNIT-IV:

Fault Diagnosis in Combinational Circuits:

Faults classes and models, fault diagnosis and testing, fault detection test, test generation, testing process, obtaining a minimal complete test set, circuit under test methods- Path sensitization method, Boolean difference method, properties of Boolean differences, Kohavi algorithm, faults in PLAs, PLA test generation, DFT schemes, built in self-test. Fault tolerance techniques

UNIT-V:

Fault Diagnosis in Sequential Circuits:

Fault detection and location in sequential circuits, circuit test approach, initial state identification, Hamming experiments, synchronizing experiments, machine identification, distinguishing experiment, adaptive distinguishing experiments.

Text Books:

1. Logic Design Theory, N. N. Biswas, PHI.
2. Switching and Finite Automata Theory, Z. Kohavi, TMH, 2nd Edition, 2001.

Reference Books:

1. Fundamentals of Logic Design, Charles H. Roth, Cengage Learning,5thEdition.
2. Digital Systems Testing and Testable Design, Miron Abramovici, Melvin A.
3. Digital Logic Applications and Design, John M Yarbrough, Thomson Learning, 2001.

PROGRAMMING LANGUAGES FOR EMBEDDED SYSTEMS
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192ES3O03	**3**	**0**	**0**	**3**

Course Objectives:
The objectives of the course are

COB 1: To understand programming concepts of Embedded C.
COB 2: To study various programming techniques in object-oriented programming.
COB 3: To be able to understand the concepts of C++ programming.
COB 4: To learn different types of overloading and inheritance.
COB 5: To describe the different templates and scripting languates.

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

CO 1: Develop the moderate complex programs in embedded C.
CO 2: Compare the different programming techniques in object-oriented programming.
CO 3: Analyze the algorithm in C++.
CO 4: Distinguish the different types of overloading & Inheritance.
CO 5: Understand the templates and scripting languages.

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(K3)	1	-	1	-	-	-	-	-	-	-	-
CO 2(K4)	2	3	-	-	-	-	-	-	-	-	-
CO 3(K3)	1	-	1	-	-	-	-	-	-	-	-
CO 4(K4)	2	-	-	-	-	-	-	-	-	-	-
CO 5(K2)	-	1	-	-	-	-	-	-	-	-	-

UNIT-I:
Embedded "C" Programming:
Bitwise operations, Dynamic memory allocation, OS services. Linked stack and queue, Sparse matrices, Binary tree. Interrupt handling in C, Code optimization issues. Embedded Software Development Cycle and Methods (Waterfall, Agile)**.**

UNIT-II:
Object Oriented Programming:
Introduction to procedural, modular, object-oriented and generic programming techniques, Limitations of procedural programming, objects, classes, data members, methods, data encapsulation, data abstraction and information hiding, inheritance, polymorphism.

UNIT-III:

CPP Programming:

"c in", "c out", formatting and I/O manipulators, new and delete operators, Defining a class, data members and methods, „this" pointer, constructors, destructors, friend function, dynamic memory allocation

UNIT-IV:

Overloading and Inheritance:

Need of operator overloading, overloading the assignment, Overloading using friends, type conversions, single inheritance, base and derived classes, friend Classes, types of inheritance, hybrid inheritance, multiple inheritance, virtual base class, Polymorphism, virtual functions.

UNIT-V:

Templates:

Function template and class template, member function templates and template arguments, Exception Handling: syntax for exception handling code: try-catch-throw, Multiple Exceptions.

Scripting Languages: Overview of Scripting Languages – PERL, CGI, VB Script, Java Script. PERL: Operators, Statements Pattern Matching etc. Data Structures, Modules, Objects, Tied Variables, Inter process Communication Threads, Compilation & Line Interfacing.

Text Books:

1. Michael J. Pont, "Embedded C", Pearson Education, 2nd Edition, 2008.
2. Randal L. Schwartz, "Learning Perl", O' Reilly Publications, 6th Edition 2011.

Reference Books:

1. A. Michael Berman, "Data structures via C++", Oxford University Press, 2002.
2. Robert Sedgewick, "Algorithms in C++", Addison Wesley Publishing Company, 1999.
3. Abraham Silberschatz, Peter B, Greg Gagne, "Operating System Concepts", John Willey & Sons, 2005 Kaufmann.

SENSORS & ACTUATORS
(Open Elective)

III Semester	L	T	P	C
Course Code: 192ES3O04	3	0	0	3

Course Objectives:

COB 1: To make students to understand basic laws and phenomena for operation of Sensors and Actuators.
COB 2: To impart the knowledge on analysis, design and development solutions for sensors and actuators.
COB 3: To enable the students to classify various thermal, radiation and smart sensors available.
COB 4: To impart the knowledge on various control values of actuators
COB 5: To make the students to understand implementation of various Actuators

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

CO 1: Classify various sensors/transducers based on their applications.
CO 2: Dissect various types of Resistive, Inductive and Capacitive Sensors.
CO 3: Analyze various approaches, procedures and results related to Thermal and Magnetic sensors.
CO 4: Examine the radiation sensors based on their characteristics.
CO 5: Apply Smart Sensors in the field of Communication, Automation and Manufacturing.
CO6: Perceive various control values and types of actuators.

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)	-	-	-	2	2	1	-	-	-	-	-
CO 2(K4)	2	3	-	3	3	3	-	-	3	-	3
CO 3(K4)	2	3	2	3	3	1	-	-	3	-	3
CO 4(K4)	2	3	2	3	3	-	2	-	3	-	3
CO 5(K3)	1	3	1	3	3	2	-	-	3	-	2
CO 6(K5)	3	3	-	3	3	3	-	-	3	-	3

UNIT-I:
Sensors / Transducers:
Principles – Classification – Parameters – Characteristics – Environmental Parameters (EP) – Characterization.
Mechanical and Electromechanical Sensors: Introduction – Resistive Potentiometer – Strain Gauge – Resistance Strain Gauge – Semiconductor Strain Gauges -Inductive Sensors: Sensitivity and Linearity of the Sensor –Types- **Capacitive Sensors:–** Electrostatic Transducer– Force/Stress Sensors Using Quartz Resonators – Ultrasonic Sensors.

UNIT-II:

Thermal Sensors: Introduction – Gas thermometric Sensors – Thermal Expansion Type Thermometric Sensors – Acoustic Temperature Sensor – Dielectric Constant and Refractive Index thermo sensors – Helium Low Temperature Thermometer – Nuclear Thermometer – Magnetic Thermometer – Resistance Change Type Thermometric Sensors –Thermo emf Sensors– Junction Semiconductor Types– Thermal Radiation Sensors –Quartz Crystal Thermoelectric Sensors – NQR Thermo metry – Spectroscopic Thermometry – Noise Thermometry – Heat Flux Sensors.

Magnetic sensors: Introduction – Sensors and the Principles Behind – Magneto-resistive Sensors – Anisotropic Magneto resistive Sensing – Semiconductor Magneto resistors– Hall Effect and Sensors – Inductance and Eddy Current Sensors– Angular/Rotary Movement Transducers – Synchros – Synchro-resolvers - Eddy Current Sensors – Electromagnetic Flow meter – Switching Magnetic Sensors SQUID Sensors.

UNIT-III:

Radiation Sensors: Introduction – Basic Characteristics – Types of Photo sensistors /Photo detectors– X-ray and Nuclear Radiation Sensors– Fiber Optic Sensors.

Electro analytical Sensors: Introduction – The Electrochemical Cell – The Cell Potential – Standard Hydrogen Electrode (SHE) – Liquid Junction and Other Potentials – Polarization – Concentration Polarization-– Reference Electrodes - Sensor Electrodes – Electro ceramics in Gas Media.

UNIT - IV:

Smart Sensors: Introduction – Primary Sensors – Excitation – Amplification – Filters – Converters – Compensation– Information Coding/Processing - Data Communication – Standards for Smart Sensor Interface – The Automation

Sensors-Applications: Introduction – On-board Automobile Sensors (Automotive Sensors)– Home Appliance Sensors – Aerospace Sensors — Sensors for Manufacturing –Sensors for environmental Monitoring.

UNIT-V:

Actuators: Pneumatic and Hydraulic Actuation Systems- Actuation systems – Pneumatic and hydraulic systems - Directional Control valves – Presure control valves – Cylinders - Servo and proportional control valves – Process control valves – Rotary actuators

Mechanical Actuation Systems: Types of motion – Kinematic chains – Cams – Gears – Ratchet and pawl – Belt and chain drives – Bearings – Mechanical aspects of motor selection Electrical Actuation Systems-Electrical systems -Mechanical switches – Solid-state switches Solenoids – D.C. Motors – A.C. motors – Stepper motors.

Text Books:

1. D. Patranabis – “Sensors and Transducers” –PHI Learning Private Limited.
2. W. Bolton – “Mechatronics” –Pearson Education Limited.

Reference Books:

1. Sensors And Actuators – D. Patranabis – 2nd Ed., PHI, 2013.

PHYSICAL DESIGN AUTOMATION
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192VD3O01	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To understand the relationship between design automation algorithms and various constraints posed by VLSI fabrication and design technology.
COB 2: To learn the design algorithms to meet the critical design parameters.
COB 3: To know the layout optimization techniques and map them to the algorithms.
COB 4: To understand proto-type EDA tools and know how to test its efficacy.

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

CO 1: Understand the relationship between design automation algorithms and various constraints posed by VLSI fabrication and design technology.
CO 2: Adapt the design algorithms to meet the critical design parameters.
CO 3: Identify layout optimization techniques and map them to the algorithms
CO 4: Develop proto-type EDA tool and test its efficacy
CO 5: Analyze the different partitioning algorithms and its evolution.

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)
CO 1(K2)	-	1	-	2	-	-	-	-	-	-	-
CO 2(K5)	-	3	-	3	-	-	-	-	-	-	-
CO 3(K3)	1	-	-	3	-	-	-	-	-	-	-
CO 4(K5)	-	-	-	-	3	-	-	-	-	-	-
CO 5(K4)	2	3	-	-	-	-	-	-	-	-	-

UNIT-I:
VLSI design Cycle, Physical Design Cycle, Design Rules, Layout of Basic Devices, and Additional Fabrication, Design styles: full custom, standard cell, gate arrays, field programmable gate arrays, sea of gates and comparison, system packaging styles, multi-chip modules. Design rules, layout of basic devices, fabrication process and its impact on physical design, interconnect delay, noise and cross talk, yield and fabrication cost.

UNIT-II:
Factors, Complexity Issues and NP-hard Problems, Basic Algorithms (Graph and Computational Geometry): graph search algorithms, spanning tree algorithms, shortest path algorithms, matching algorithms, min-cut and max-cut algorithms, Steiner tree algorithms.

UNIT-III:
Basic Data Structures, atomic operations for layout editors, linked list of blocks, bin based methods, neighbor pointers, corner stitching, multi-layer operations.

UNIT-IV:

Graph Algorithms for Physical Design:

Classes of graphs, graphs related to a set of lines, graphs related to set of rectangles, graph problems in physical design, maximum clique and minimum coloring, maximum k-independent set algorithm, algorithms for circle graphs.

UNIT-V:

Partitioning Algorithms:

Design style specific partitioning problems, group migrated algorithms, simulated annealing and evolution, and Floor planning and pin assignment, Routing and placement algorithms.

Text Books:

1. Naveed Shervani, Algorithms for VLSI Physical Design Automation, 3rd Edition, Kluwer Academic,1999.
2. Charles J Alpert, Dinesh P Mehta, Sachin S Sapatnekar, Handbook of Algorithms for Physical Design Automation, CRC Press,2008.

Web Links:

1. https://nptel.ac.in/courses/106105161/
2. https://eecs.wsu.edu/~daehyun/teaching/2014_EE582/
3. http://users.ece.utexas.edu/~dpan/PDA_syllabus.pdf

VLSI TECHNOLOGY
(Open Elective)

III Semester	L	T	P	C
Course Code: 192VD3O02	3	0	0	3

Course Objectives:

COB 1: To impart the knowledge on basic properties of MOS transistors based on different circuit parameters.
COB 2: To enable the students to learn the MOS fabrication process.
COB 3: To make students to familiar with layout designing rules.
COB 4: To enable the students to design and analyze various combinational logic networks and sequential systems.

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

CO 1: Summarize characteristics of MOS transistors.
CO 2: Outline the MOS fabrication process and short channel effects.
CO 3: Identify the basic rules in layout designing.
CO 4: Analyze various combinational logic networks and sequential systems.

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	-	-	-	-	-	-	-	-	-
CO2 (K3)	3	2	2	-	-	-	-	-	-	-	-
CO3 (K4)	3	3	2	-	3	-	-	-	-	-	-
CO4 (K3)	3	3	2	2	3	-	-	-	-	-	-

UNIT-I:
MOS Transistors:
Introduction, The Structure of MOS Transistors, The Fluid Model, The MOS Capacitor, The MOS Transistor, Modes of Operation of MOS Transistors, Electrical Characteristics of MOS Transistors, Threshold Voltage, Transistor Trans conductance eg$_m$, Figure of Merit, Body Effect, Channel-Length Modulation, MOS Transistors as a Switch, Transmission Gate.

UNIT-II:
MOS Fabrication Technology:
Introduction, Basic Fabrication Processes, Wafer Fabrication, Oxidation, Mask Generation, Photolithography, Diffusion, Deposition. N-MOS Fabrication Steps, CMOS Fabrication Steps, n-Well Process, p-Well Process, Twin-Tub Process, Latch-Up Problem and Its Prevention, Use of GuardRings,UseofTrenches,Short-ChannelEffects-ChannelLengthModulationEffect.Drain-InducedBarrierLowering, Channel Punch Through, Hot carrier effect, Velocity Saturation Effect.

UNIT-III:

Layout Design Rules:

Scaling Theory, Scalable CMOS Design Rules, CMOS Process Enhancements, Transistors-Interconnects, Circuit Elements, Efficient lay out Design techniques.

UNIT-IV:

Combinational Logic Networks:

Lay outs for logic networks, Delay through networks, Power optimization, Switch logic net works. Combinational logic testing.

UNIT-V:

Sequential Systems:

Memory cells and Arrays, clocking disciplines, sequential circuit Design, Performance Analysis, Power optimization, Design validation and testing.

Text Books:

1. Principals of CMOS VLSI Design-N.H.E Weste,K. Eshraghian, 2nd Edition, Addison Wesley.
2. CMOS Digital Integrated Circuits Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 3rd Ed., 2011.
4. Low-Power VLSI Circuits and Systems, Ajit Pal, SPRINGER PUBLISHERS.
5. Modern VLSI Design – Wayne Wolf, 3rd Ed., 1997, Pearson Education.

Reference Books:

1. Digital Integrated Circuit Design – Ken Martin, Oxford University Press, 2011.
2. Digital Integrated Circuits – A Design Perspective, Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, 2nd Ed., PHI.

Web Links:

1. www.mmumullana.org/downloads/files/n54744b1ab8147.pdf
2. https://www.tutorialspoint.com/vlsi_design/vlsi_design_digital_system.html
3. https://www.ikbooks.com/home/samplechapter?filename=26_Sample_Chapter.Pdf
4. https://www.electronics-tutorial.net/Digital-CMOS-Design/CMOS-Layout-Design/ Layout-Design-Rules/

NANO-ELECTRONICS
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192VD3O03	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To enable the students to know the fundamentals of VLSI technologies.
COB 2: To impart the knowledge on basic properties of MOS devices based on different circuit parameters.
COB 3: To enable the students to learn novel MOS based silicon devices and various multi gate devices.
COB 4: To train the students working of spin electronic devices
COB 5: To make students to familiar with different nanoelectronics building blocks such as carbon nanotubes, quantum dots, nano wires.

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

CO 1: Demonstrate challenges due to scaling on CMOS devices.
CO 2: Analyse and explain working of novel MOS based silicon devices and various multi gate devices.
CO 3: Analyse working of spin electronic devices
CO 4: Summarize nano electronics systems and building blocks such as: low dimensional semiconductors, hetero structures, carbon nano tubes, quantum dots, nanowires etc.
CO 5: Develop nano electronics systems and building blocks such as: carbon nanotubes, quantum dots, nanowires etc.
CO 6: Explain various design methodologies for chip design.

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	-	2	2	3	-	1	1	1	3
CO 2(K4)	2	3	2	2	2	3	-	1	1	1	3
CO 3(K4)	2	3	2	2	2	3	-	1	1	1	3
CO 4(K2)	1	2	-	3	-	-	-	-	-	-	-
CO 5(K3)	-	2	-	3	3	2	-	2	2	2	2
CO 6(K5)	3	2	3	1	1	2	1	-	-	-	2

UNIT-I:
Properties of Individual Nano particles:
Introduction, Metal Nano Clusters, Semiconducting Nanoparticles, Rare Gas and Molecular Clusters, Methods of Synthesis.

UNIT-II:
The nanoscale MOSFET, Fin FETs, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.), Resonant Tunneling Transistors.
Carbon Nano Structures: Introduction, Carbon Molecules, Carbon Clusters, Carbon Nano Tubes, Application of Carbon Nanotubes.

UNIT-III:

Carbon Nanotubes for Data Processing–Introduction, Electronic Properties, Synthesis of Carbon Nanotubes, Carbon Nanotube Interconnects, Carbon Nanotubes Field Effect Transistors (CNTFETs), Nanotubes for Memory Applications, Prospects of an All-CNT Nanoelectronics.

Neuro electronic Interfacing: Semiconductor Chips with Ion Channels, Nerve Cells, and Brain: Introduction, Ion-Electronic Interface, Neuron-Silicon Circuits, Brain-Silicon Chips.

UNIT-IV:

Optical3-DTime-of-Flight Imaging System: Introduction, Taxonomy of Optical3-DTechniques, CMOS Imaging, CMOS 3-D Time-of-Flight Image Sensor, Application Examples

Pyroelectric Detector Arrays for IR Imaging: Introduction, Operation Principle of Pyro electric IR Detectors, Pyroelectric Materials, Realized Devices, Characterization, and Processing Issues

UNIT-V:

Electronic Noses:

Introduction, Operating Principles of Gas Sensor Elements, Electronic Noses, Signal Evaluation, Dedicated Examples.

2-DTactile Sensors and Tactile Sensor Arrays: Introduction, Definitions and Classifications, Resistive Touch screens, Ultrasonic Touchscreens, Robot Tactile Sensors, Fingerprint Sensors.

Text Books:

1. Introduction to Nanotechnology, C.P. Poole Jr., F.J. Owens, Wiley (2003).
2. Nano electronics and Information Technology (Advanced Electronic Materials and Novel Devices), Waser Ranier, Wiley-VCH,2003.

Reference Books:

1. Nano systems, K.E. Drexler, Wiley (1992).
2. The Physics of Low-Dimensional Semiconductors, John H.Davies, “Cambridge University Press," 1998.

Web Links:

1. https://www.nano.gov/html/facts/faqs.html
2. https://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_003.pdf
3. http://www.nanobuildings.com

PYTHON PROGRAMMING
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code:192CS3O01	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To impart the knowledge on Scripting Languages.
COB 2: To facilitate the students, apply control statements and functions in Python Scripts.
COB 3: To make the students learn lists, tuples and dictionaries in Python.
COB 4: To demonstrate the Object Oriented Concepts.
COB 5: To enable the students design and develop applications using database connectivity.

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

CO 1: Apply fundamental concepts of Python programming language.
CO 2: Develop programs using control statements.
CO 3: Use data structures in Python to solve various problems.
CO 4: Develop programs using functions, strings and files.
CO 5: Make Use of Standard libraries like math, turtle, tkinter, re etc. in building real time applications.
CO 6: Discuss on Object Oriented Programming concepts and Exceptions.
CO 7: Design various applications using database connectivity.

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(K3)	3	3	-	-	3	-	-	-	-	-	-
CO2(K3)	3	2	-	-	-	-	-	-	-	-	-
CO3(K3)	-	2	1	1	-	-	-	-	-	-	3
CO4(K3)	3	-	-	-	3	-	-	-	-	-	-
CO5(K3)	-	-	-	1	3	-	-	-	-	-	3
CO6(K2)	-	1	-	-	2	-	-	-	-	-	2
CO7(K3)	3	2	1	1	3	-	-	-	-	-	3

UNIT-I:
Instant Hacking:
The Basics: Installing Python, The Interactive Interpreter, Numbers and Expressions, variables, statements, Getting input from the user, Saving and Executing your programs, Strings.
Conditionals, loops and Some Other statements: More about print and import, Assignment magic, The joy of indentation, Conditions and conditional statements: if clause, else clause, elif clause, nesting blocks, loops: while , for, breaking out of loops, else clause in loops.

UNIT-II:

Working with Strings:

Basic string operations, String Formatting, String Methods.

Lists and Tuples: Common sequence Operations, Lists, Tuples, Immutable sequences, the tuple function, basic tuple operations.

Dictionaries: When Indices won't do: dictionary uses, creating and using dictionaries, basic dictionary operations, string formatting with dictionaries, dictionary methods. Sets, set methods, comprehensions.

UNIT-III:

Functions:

Function Parameters, Local variables, the global statement, Default Argument values, Keyword Arguments, var Args parameters, the return statement. Anonymous Functions(lambda), Doc strings.

Modules: The from … import statement, A module's name, Making your own modules, The dir function, packages.

Brief Tour of the Standard Library: re, math, datetime, turtle, tkinter.

UNIT-IV:

Object Oriented Programming:

The self, Classes, Methods, The in it Method, class and object variables, Inheritance.

Exceptions: Errors, Exceptions, Handling exceptions, Raising exceptions, Try … finally, User Defined Exceptions.

UNIT-V:

Files and stuff:

Opening files, The basic file methods: reading and writing, piping output, reading and writing lines, closing files, using the basic file methods, Iterating over file contents.

Database Support: Working with a Database, Python and SQLite, creating an SQLite DB, creating a table, inserting a record, pulling the data from DB, using where, Update and Delete records.

Text Books:

1. Beginning Python: from Novice to Professional, Lie Het land, Magnus, 2nd Edition.
2. A Byte of Python, Swaroop C H, 3rd Edition.
3. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.

Reference Books:

1. Think Python, Allen Downey, Green Tea Press.
2. Python for Everybody Exploring Data in Python 3, Charles Russell Severance, Sue Blumenberg.
3. Learning Python, Mark Lutz, Orielly.
4. Introduction to Python, Kenneth A. Lambert, Cengage.
5. Python Programming-using problem solving approach, Reema Thareja, Oxford.

Web Links:

1. https://onlinecourses.nptel.ac.in/noc18_cs35
2. https://www.Python.org/
3. http://www.geeksforgeeks.org/Python/
4. https://www.coursera.org/courses?query=Python%20programming
5. https://www.learnPython.org/
6. https://www.techbeamers.com/python-tutorial-step-by-step/

PRINCIPLES OF CYBER SECURITY
(Open Elective)

III Semester	L	T	P	C
Course Code:192CS3O02	3	0	0	3

Course Objectives:

COB 1: To Demonstrate cybercrime fundamentals.
COB 2: To Inspect cyber offence planning.
COB 3: To Discuss with student about cybercrime on mobile and wireless devices.
COB 4: To Inspect cybercrime methods and tools.
COB 5: To Know Importance of cyber security and cyber laws.

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

CO 1: Illustrate cybercrime fundamentals.
CO 2: Analyze cyber offence planning.
CO 3: Interpret cybercrime on mobile and wireless devices.
CO 4: Distinguish type of tools and methods used in cyber crimes.
CO 5: Explain the importance of cyber security.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO1 (K5)	PO2 (K4)	PO3 (K5)	PO4 (K3)	PO5 (K3)	PO6 (K4)	PO7 (K6)	PO8 (K2)	PO9 (K2)	PO10 (K2)	PO11 (K4)
CO 1(K2)	2	1	-	-	2	-	-	-	-	-	-
CO 2(K4)	3	3	2	2	3	-	-	-	-	-	-
CO 3(K5)	3	3	3	3	3	-	-	-	-	-	-
CO 4(K4)	3	3	2	2	3	-	-	-	-	-	-
CO 5(K2)	2	1	-	-	2	-	-	-	-	-	-

UNIT-I:
Introduction to Cybercrime:
Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens.

UNIT-II:
Cyber Offenses:
How Criminals Plan Them –Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Cloud Computing.

UNIT-III:
Cybercrime Mobile and Wireless Devices:
Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security

Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT-IV:

Tools and Methods Used in Cybercrime:

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft)

UNIT-V:

Cybercrimes and Cyber security:

Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Information Security Planning and Governance, Information Security Policy Standards, Practices, The information Security Blueprint, Security education, Training and awareness program, Continuing Strategies.

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, Sunit Belapure, Wiley.
2. Principles of Information Security, Micheal E.Whitman and Herbert J.Mattord, Cengage Learning.

Reference Books:

1. Information Security, Mark Rhodes, Ousley, MGH.

Web Links:

1. https://www.edx.org/micromasters/ritx-cybersecurity.
2. https://www.coursera.org/specializations/cyber-security.
3. https://www.nptel.ac.in/courses/106105031/.
4. http://bedford-computing.co.uk/learning/wp-content/uploads/2016/08/Principles-of-Information-Security-4th-ed.-Michael-E.-Whitman.pdf
5. https://www.wileyindia.com/cyber-security-understanding-cyber-crimes-computer-forensics-and-legal-perspectives.html

INTERNET OF THINGS
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code:192CS3O03	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To Understand Smart Objects and IoT Architectures.
COB 2: To learn about various IOT-related protocols
COB 3: To build simple IoT Systems using Arduino and Raspberry Pi.
COB 4: To understand data analytics and cloud in the context of IoT.
COB 5: To develop IoT infrastructure for popular applications.

Course Outcomes:
After the completion of the course, student will be able to

CO 1: Summarize on the term 'internet of things' in different contexts.
CO 2: Analyze various protocols for IoT.
CO 3: Design a PoC of an IoT system using Rasperry Pi/Arduino.
CO 4: Apply data analytics and use cloud offerings related to IoT.
CO 5: Analyze applications of IoT in real time scenario.

Mapping of Course Outcomes with Program Outcomes

CO/PO	PO1 (K5)	PO2 (K4)	PO3 (K5)	PO4 (K3)	PO5 (K3)	PO6 (K4)	PO7 (K6)	PO8 (K2)	PO9 (K2)	PO10 (K2)	PO11 (K4)
CO1(K2)	3	-	-	1	-	-	-	-	-	-	-
CO2(K3)	3	3	2	-	-	-	-	-	-	-	-
CO3(K3)	3	2	3	-	-	-	-	-	-	-	-
CO4(K3)	3	3	1	2	-	-	-	-	-	-	-
CO5(K4)	3	3	2	-	-	-	-	-	-	-	-

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.

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:

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:

Cisco IoT system, IBM Watson IoT platform, Manufacturing, Converged Plant wide Ethernet Model (CPwE), Power Utility Industry, Grid Blocks Reference Model, Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

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

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 Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit2).
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 Avesand. 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.

MACHINE LEARNING
(Open Elective)

III Semester	L	T	P	C
Course Code:192CS3O04	3	0	0	3

Course Objectives:

COB 1: Develop an appreciation for what is involved in learning from data.
COB 2: Demonstrate a wide variety of learning algorithms.
COB 3: Demonstrate how to apply a variety of learning algorithms to data.
COB 4: Demonstrate how to perform evaluation of learning algorithms and model selection.

Course Outcomes:
At the end of this course the student will be able to:

CO 1: Domain Knowledge for Productive use of Machine Learning and Diversity of Data.
CO 2: Demonstrate on Supervised and Computational Learning problems.
CO 3: Analyze on Statistics in learning techniques and Logistic Regression.
CO 4: Illustrate on Support Vector Machines and Perceptron Algorithm.
CO 5: Design a Multilayer Perceptron Networks and classification of decision tree.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1 (K5)	PO2 (K4)	PO3 (K5)	PO4 (K3)	PO5 (K3)	PO6 (K4)	PO7 (K6)	PO8 (K2)	PO9 (K2)	PO10 (K2)	PO11 (K4)
CO1 (K3)	3	2	-	-	2	-	-	-	-	-	-
CO2 (K3)	3	2	1	-	3	-	-	-	-	-	-
CO3 (K3)	3	2	1	-	3	-	-	-	-	-	-
CO4 (K3)	3	2	1	-	3	-	-	-	-	-	-
CO5 (K3)	3	3	3	-	3	-	-	-	-	-	-

UNIT-I:
Introduction-Towards Intelligent Machines, Well posed Problems, Example of Applications in diverse fields, Data Representation, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured / Unstructured, Forms of Learning, Machine Learning and Data Mining, Basic Linear Algebra in Machine Learning Techniques.

UNIT-II:
Supervised Learning- Rationale and Basics: Learning from Observations, Bias and Why Learning Works: Computational Learning Theory, Occam's Razor Principle and Overfitting Avoidance Heuristic Search in inductive Learning, Estimating Generalization Errors, Metrics for assessing regression, Metris for assessing classification.

UNIT-III:
Statistical Learning- Machine Learning and Inferential Statistical Analysis, Descriptive Statistics in learning techniques, Bayesian Reasoning: A probabilistic

approach to inference, K-Nearest Neighbor Classifier. Discriminant functions and regression functions, Linear Regression with Least Square Error Criterion, Logistic Regression for Classification Tasks, Fisher's Linear Discriminant and Thresholding for Classification, Minimum Description Length Principle.

UNIT-IV:

Support Vector Machines (SVM)- Introduction, Linear Discriminant Functions for Binary Classification, Perceptron Algorithm, Large Margin Classifier for linearly separable data, Linear Soft Margin Classifier for Overlapping Classes, Kernel Induced Feature Spaces, Nonlinear Classifier, Regression by Support vector Machines.

Learning with Neural Networks: Towards Cognitive Machine, Neuron Models, Network Architectures, Perceptron's, Linear neuron and the Widrow-Hoff Learning Rule, The error correction delta rule.

UNIT-V: Multilayer Perceptron Networks and error back propagation algorithm, Radial Basis Functions Networks.

Decision Tree Learning: Introduction, Example of classification decision tree, measures of impurity for evaluating splits in decision trees, ID3, C4.5, and CART decision trees, pruning the tree, strengths and weakness of decision tree approach.

Text Books:

1. Applied Machine Learning,1e, M. Gopal, Mc Graw Hill Education,2018.

Reference Books:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press,2012.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online).
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer,2007.

Web Links:

1. https://www.coursera.org/learn/machine-learning
2. https://classroom.udacity.com/courses/ud120
3. http://videolectures.net/Top/Computer_Science/Machine_Learning/
4. https://onlinecourses.nptel.ac.in/noc18_cs26
5. https://www.youtube.com/channel/UCR4_akQ1HYMUcDszPQ6jh8Q

ARTIFICIAL INTELLIGENCE
(Open Elective)

III Semester	L	T	P	C
Course Code:192CS3O05	3	0	0	3

Course Objectives:

COB 1: To enable the students to learn AI concepts.
COB 2: To illustrate different searching techniques.
COB 3: To impart the knowledge on various logical systems.
COB 4: To make the students learn different knowledge representation techniques.
COB 5: To facilitate the students to fuzzy logic and reasoning to solve scientific problems.

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

CO 1: Describe the fundamentals of Artificial Intelligence and its applications.
CO 2: Illustrate the time and space complexities of searching techniques.
CO 3: Apply various logical systems to inference the different logical problems.
CO 4: Create knowledge structure using traditional and complex structures and Advanced knowledge representation techniques.
CO 5: Apply Fuzzy Logic and Reasoning to handle Uncertainty for solving scientific Problems.

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)	2	1	-	-	2	-	-	-	-	-	-
CO3 (K3)	3	2	1	1	3	-	-	-	-	-	-
CO4 (K3)	3	2	1	1	3	-	-	-	-	-	-
CO5 (K3)	3	2	1	1	3	-	-	-	-	-	-

UNIT-I:

Introduction to Artificial Intelligence:
Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of ai languages, current trends in AI.

UNIT-II:

Problem Solving: State-Space Search and Control Strategies:
Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative- deepening a*, constraint satisfaction.
Problem Reduction and Game Playing: Introduction, problem reduction, game playing, alpha- beta pruning, two-player perfect information games.

UNIT-III:

Logic Concepts:

Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic.

UNIT-IV:

Knowledge Representation:

Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames.

Advanced Knowledge Representation Techniques: Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web.

UNIT-V:

Expert System and Applications:

Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tool.

Text Books:

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
2. Artificial intelligence, A modern Approach, 2nd ed, Stuart Russel, Peter Norvig, PEA
3. Artificial Intelligence- Rich, Kevin Knight, Shiv Shankar B Nair, 3rd ed, TMH
4. Introduction to Artificial Intelligence, Patterson, PHI.

Reference Books:

1. Artificial Intelligence, Rich, Kevin Knight, Shiy Shankar B Nair, 3rd Edition, TMH, 2009.
2. Introduction to Artificial Intelligence, Patterson, 1st Edition, PHI,2015.
3. Artificial intelligence structures and Strategies for Complex problem solving, George F Lugar, 5th Edition, PEA,2009.
4. Introduction to Artificial Intelligence, Ertel, Wolf Gang, 1st Edition, Springer, 2011.
5. Artificial Intelligence: Anew Synthesis, NilsJNilsson,1st Edition, Elsevier, 1997.

Web Links:

1. https://www.tutorialspoint.com/artificial_intelligence/
2. https://onlinecourses.nptel.ac.in/noc17_cs30/
3. https://www.slideshare.net/girishnaik/artificial-intelligence-3638681/
4. https://www.mindmeister.com/44054594/expert-systems/
5. https://in.udacity.com/course/intro-to-artificial-intelligence--cs271/

DEEP LEARNING
(Open Elective)

III Semester	L	T	P	C
Course Code:192CS3O06	3	0	0	3

Course Objectives:

COB 1: To impart the knowledge on learning methods for working with sequential data.
COB 2: To illustrate recurrent and memory networks.
COB 3: To make the students learn deep Turing machines.
COB 4: To enable the students, apply deep learning mechanisms to various learning problems.
COB 5: To provide the knowledge on open issues in deep learning, and have a grasp of the current research directions.

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

CO 1: Demonstrate the basic concepts fundamental learning techniques and layers.
CO 2: Discuss the Neural Network training, various random models.
CO 3: Identify different types of deep learning network models.
CO 4: Classify the Probabilistic Neural Networks.
CO 5: Implement tools on Deep Learning 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)	-	1	-	-	-	-	-	-	-	-	-
CO2 (K2)	-	1	-	2	-	-	-	-	-	-	-
CO3 (K2)	1	3	3	-	3	-	-	-	-	-	-
CO4 (K3)	1	-	3	-	3	-	-	-	-	-	-
CO5 (K3)	1	2	3	3	-	-	-	-	-	-	-

UNIT-I:
Introduction:
Various paradigms of learning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.
Feed Forward Neural Network: Artificial Neural Network, activation function, multi-layer neural network.

UNIT-II:
Training Neural Network:
Risk minimization, loss function, back propagation, regularization, model selection, and optimization.
Conditional Random Fields: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.

UNIT-III:

Deep Learning:

Deep Feed Forward network, regularizations, training deep models, dropouts, Convolution Neural Network, Recurrent Neural Network, and Deep Belief Network.

UNIT-IV:

Probabilistic Neural Network:

Hopfield Net, Boltzmann machine, RBMs, Sigmoid net, Auto encoders.

UNIT-V:

Applications:

Object recognition, sparse coding, computer vision, natural language processing. **Introduction to Deep Learning Tools:** Caffe, Theano, Torch.

Text Books:

1. Goodfellow, I., Bengio, Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Bishop, C., M., Pattern Recognition and Machine Learning, Springer, 2006.

Reference Books:

1. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.
2. Matrix Computations, Golub, G., H., and Van Loan, C., F, JHU Press, 2013.
3. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education, 2004.

Web Links:

1. https://nptel.ac.in/courses/106106184/#
2. https://www.simplilearn.com/deep-learning-tutorial
3. https://www.tutorialspoint.com/python_deep_learning/index.htm
4. https://www.digitalvidya.com/blog/deep-learning-tutorial/

INTRODUCTION TO PETROLEUM ENGINEERING
(Open Elective)

III Semester	L	T	P	C
Course Code: 192PE3O01	3	0	0	3

Course Objectives:

COB 1: To help the students to understand the basic principles and mechanisms adopted in Petroleum engineering methodologies.
COB 2: To impart theoretical knowledge on various principles associated to various fundamental petroleum upstream.
COB 3: To teach the students various principles associated to Upstream operations.
COB 4: To help the student's various principles associated to gathering oil and gas and storage.
COB 5: To impart knowledge on available in downstream processing.

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

CO 1: Understand the role of petroleum engineers in various facets of petroleum exploration, production, transportation, refining and processing.
CO 2: Students get motivated to work for the energy security after knowing the present scenario of petroleum and natural gas.
CO 3: Analyze various case studies available in petrochemical, fine chemical, bioprocesses and carbon capture.
CO 4: Explain the principal involved in gathering oil and gas storage.
CO 5: Understand the basic concepts of Downstream 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 (K1)	3	2	1	2	-	-	-	-	-	-	-
CO2 (K2)	2	2	1	2	-	1	-	-	-	-	-
CO3 (K2)	3	2	1	2	-	-	-	-	-	-	-
CO4 (K1)	3	2	-	1	1	-	-	-	-	-	-
CO5 (K2)	2	2	-	2	1	-	1	-	-	1	1

UNIT-I:
Introduction:
What is Petroleum Engineering & Significance? Introduction Petroleum Industry-Upstream Sector
Midstream Processing-Downstream Processing-Indian and World Scenario of Petroleum and Natural Gas- Petroleum Trade- Geopolitics.

UNIT-II:
Upstream Sector-1:
Exploration & Production –Indian and World Scenario of Petroleum and Natural Gas Resources- The Reservoir –Reservoir fluids- Hydrocarbon Phase diagrams- Onshore and Offshore Reservoirs Reservoir Drives.

UNIT-III:

Upstream Sector-2:

Exploration and Drilling Rigs- Rig Components-Drill and drill bits- Drilling fluids-Well Completions. Production System: Sketches of Well - Well head- Christmas tree and Casing and various other parts, Cementing-Safety Systems- **Subsea Wells**: Drilling & Completion and Production Artificial Lift: Principles and operation of Rod Pumps – Downhole Pumps – Gas Lift – Plunger Lift, Electrical submersible pumps. Well Workover and Intervention- Well Stimulation: Matrix Acidizing and Hydro-fracturing.

UNIT-IV:

Gathering of Oil & Gas and Storage:

Well Tubing- Separation of Reservoir Fluids- Manifolds and Gathering – Production Separators – Gas Treatment and Compression - Oil & Gas Storage, Metering and Export.

Midstream processing: Transportation of Crude Oil & its Products and Natural Gas-- World and Indian pipeline scenario- Design of Oil and Gas pipelines - Safety aspects of pipelines Environmental issues.

UNIT-V:

Downstream Processing:

Crude Oil Refining: Classification and Composition – Constituents - Products and their specifications– Pre-treatment of crude oil- Refinery distillation- Safety in refinery operations.

Text books:

1. Havard Devold, Oil and Gas Production Handbook: An Introduction to Oil & Gas Production, ABB ATPA Oil and Gas, 2006.
2. John R. Fanchi and Christiansen, R.L., Introduction to Petroleum Engineering, John Wiley & Sons, 2017.

Reference Books:

1. John R. Fanchi and Christiansen, R.L., Introduction to Petroleum Engineering, John Wiley & Sons, 2017.

Web Links:

1. https://www.sciencedirect.com/book/9780750689410/process-intensification
2. https://www.sciencedirect.com/science/article/pii/B9780750689410000043
3. http://www.yourarticlelibrary.com/energy/solar-energy-10-major-application-of-solar-energy-explained/28197
4. https://en.wikipedia.org/wiki/Digital_divide

PROCESS INTENSIFICATION
(Open Elective)

III Semester **L T P C**
Course Code: 192PE3O02 **3 0 0 3**

Course Objectives:

COB 1: To help the students to understand the basic principles and mechanisms adopted in process intensification methodologies.
COB 2: To impart theoretical knowledge on various principles associated to various unit operations and unit processes.
COB 3: To teach the students various principles associated to various unit operations.
COB 4: To help the student's various principles associated to various unit operations and unit processes.
COB 5: To impart knowledge on available in petrochemical, fine chemical, pharmaceutical, carbon capture and bioprocess engineering to understand the role of process intensification to improve process performance.

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

CO 1: Apply the basic principles and mechanisms that are responsible for process intensification.
CO 2: Analyze various modifications to process equipment and designs with which process intensification becomes a reality in unit operations and unit processes.
CO 3: Analyze various case studies available in petrochemical, fine chemical, bioprocesses and carbon capture.
CO 4: Correlate textbook reported methodologies with Computational Fluid Dynamics.
CO 5: Correlate textbook reported methodologies with experimental process intensification.

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 (K1)	3	2	1	2	-	-	-	-	-	-	-
CO2 (K2)	2	2	1	2	-	1	-	-	-	-	-
CO3 (K2)	3	2	1	2	-	-	-	-	-	-	-
CO4 (K1)	3	2	-	1	1	-	-	-	-	-	-
CO5 (K2)	2	2	-	2	1	-	1	-	-	1	1

UNIT-I:

History of Process Intensification: Rotating boilers–Rotating non-pipe–Separators–Rotating heat transfer devices.

Overview of Process Intensification: Definition of Process Intensification (PI)–Advantages of PI – Obstacles to PI.

UNIT-II:

Mechanisms Involved in Process Intensification: Mechanisms involved in heat transfer intensification –Electrically enhanced process intensification – Microfluidics – Pressure.

Compact and Micro-heat exchangers & Process Intensification: Plate, Printed-circuit, Chart-flow, Polymer film, Foam and mesh heat exchangers – Micro-heat exchangers – Small channels – Nano fluids.

UNIT-III:

Downhole Separation Technology: Gravity Separation, Hydro-cyclone Seperation, Membrane Separation, Field Applications.

UNIT-IV:

Application of Solar Energy in Offshore Oil and Gas Operations: photovoltaics cells, concentrating solar power, hot oil circulation.

UNIT-V:

Application of Divided Wall Distillation technology in separation of NGL

Process Intensification for Carbon capture: Intensification of post combustion carbon capture processes – Intensification of other carbon capture processes.

Text books:

1. Process Intensification: Engineering for Efficiency, Sustainability and Flexibility, D. Reay, C. Ramshaw and A. Harvey, Butterworth-Heinemann, 1st Edition, Burlington, 2008.

Reference Books:

1. Re-Engineering the Chemical Processing Plant: Process Intensification, A. Stankiewicz and J.A. Moulijn (Editors), Marcel Dekker, New York, 2004.

Web Links:

1. https://www.sciencedirect.com/book/9780750689410/process-intensification
2. https://www.sciencedirect.com/science/article/pii/B9780750689410000043
3. http://www.yourarticlelibrary.com/energy/solar-energy-10-major-application-of-solar-energy-explained/28197
4. https://en.wikipedia.org/wiki/Digital_divide

FUNDAMENTALS OF LIQUEFIED NATURAL GAS
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192PE3O03	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To impart the knowledge of world and Indian scenario of LNG industry.
COB 2: To demonstrate the liquefaction technologies of LNG.
COB 3: To impart the knowledge on supporting functional units of LNG plants.
COB 4: To help the students learn about LNG shipping industry.
COB 5: To impart knowledge on major equipment and safety aspects of LNG industry.

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

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 (K2)	3	2	-	-	1	-	-	-	-	-	-
CO3 (K2)	3	-	-	-	-	-	-	-	-	-	-
CO4 (K2)	3	1	-	-	-	-	-	-	-	-	-
CO5 (K1)	3	2	-	-	3	-	-	-	-	-	-

UNIT–I:
Introduction:
Overview of LNG industry: History of LNG industry – Base load LNG – Developing an LNG Project – World and Indian Scenario – Properties of LNG.

UNIT–II:
Liquefaction Technologies:
Propane precooled mixed refrigerant process – Description of Air products C_3MR LNG process – Liquefaction – LNG flash and storage.
Cascade process: Description of ConocoPhillips optimized cascade (copoc) process – Liquefaction – LNG flash and storage. Offshore LNG production.

UNIT–III:
Supporting Functional Units in LNG Plants:
Gas pretreatment: Slug catcher – NGLstabilization 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 ofmarine facilities – storage capacity – Process descriptions. Integration with adjacent facilities – Gas interchangeability.

LNG Shipping Industry: LNG Shipping Industry: LNG fleet – Types of LNG ships – Moss – Membrane – prismatic.

UNIT–V:

Major equipment in LNG industry – Cryogenic heat exchangers: Spiral – Wound heat exchangers – Plate &fin heat exchangers – Cold boxes; LNG pumps and liquid expanders – Loading Arms and gas turbines.

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.

Text Books:

1. LNG: Basics of Liquified Natural Gas, Stanley Huang, Hwa Chiu 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.

Reference Books:

1. Natural Gas by Sea: The Development of a new technology, Roger Rooks, Wither by, 1993.
2. Natural Gas: Production, Processing, and Transport, Alexandre Rojey, 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

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/index. 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.pdf.

SUBSEA ENGINEERING
(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192PE3O04	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To illustrate overall view of subsea engineering.
COB 2: To understand the subsea development operations.
COB 3: To learn the hydraulic / equipment / system design considerations.
COB 4: To learn the process control and power supply consideration.
COB 5: To understand the reliability issues& design challenges involving subsea systems.

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

CO 1: Explain Overall View of subsea engineering.
CO 2: Explain the Subsea Distribution System.
CO 3: Identification and monitoring of Subsea Control.
CO 4: Studies on Subsea Power Supply, Subsea systems engineering.
CO 5: Understanding the Hydrates, Wax and Asphaltenes.

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	-	-	-	-	-	-	-	-	-
CO2 (K2)	-	3	-	-	-	-	2	1	-	-	-
CO3 (K1)	2	3	-	1	-	-	-	-	-	-	-
CO4 (K2)	1	-	-	-	-	3	-	-	-	-	-
CO5 (K2)	-	-	2	-	2	-	-	-	-	-	1

UNIT-I:

Overall View of Subsea Engineering:

Subsea production systems, flow assurance & system engineering, subsea structures & equipment, subsea pipelines.

Subsea Field Development: Subsea field development overview, Deepwater or shallow water development, wet tree &Drain tree Systems, Subsea Tie-Back Development, Standalone Development, Artificial lift methods and constraints, subsea processing, template, clustered well systems & daisy Chain, Subsea Field Development Assessment

UNIT-II:

Subsea Distribution System:

Design Parameters, SDS Component Design Requirements.

Installation & Vessels: Typical Installation Vessels, Vessel Requirements & Selection, Installation Positioning & Analysis.

UNIT-III:

Subsea Control: Types of Control Systems, Topside Equipment, SCMMB, SCM, Subsea Transducers & Sensors, HIPPS, SPCS, IWOCS.

Subsea Power Supply: Electrical Power System, Hydraulic Power System.

Subsea System Engineering: Typical Flow Assurance Process, System Design & Operability.

UNIT-IV:

Hydraulics: composition & Properties of hydrocarbon, emulsion, Phase Behavior, Hydraulic Flow, Slugging & liquid Handling, Slug Catcher Design, Pressure Surge, Line Sizing.

Heat Transfer & Thermal Insulation: Heat Transfer Fundamentals, U Value, Steady State, Transient Heat Transfer, Thermal Management Strategy & Insulation.

UNIT -V:

Hydrates: Physics & Phase behavior, Hydrate prevention, Hydrate Remediation, Hydrate Control design philosophies, Recovery of Thermodynamic hydrate Inhibitors. Wax &Asphaltenes: Wax, Wax Management, Wax Remediation, Asphaltenes, Asphaltenes control design Philosophies

Text Books:

1. Subsea Engineering Handbook, Yong Bai & Qiang Bai, Gulf Professional Publishing, New York, 2012.
2. Offshore Drilling and Completions Training Manual, Drill-Quip, Inc
3. Manual on Subsea Technology, IOGPT, ONGC.

Reference Books:

1. Manual on Subsea Technology, IOGPT, ONGC.
2. Offshore Drilling and Completions Training Manual, Drill-Quip, Inc

Web Links:

1. http://www.oilfieldwiki.com/wiki/Subsea_field_development
2. http://www.oilfieldwiki.com/wiki/Subsea_distribution_system
3. https://www.offshore-mag.com/learning-center/subsea/subsea-production-systems/subsea-control-systems.html
4. https://www.stress.com/capabilities/upstream/subsea-engineering/subsea-systems/
5. http://ijcoe.org/article-1-35-en.pdf

GEOLOGY
(Open Elective)

III Semester **L T P C**
Course Code: 192PE3O05 **3 0 0 3**

Course Objectives:

COB 1: To introduce the students to the general knowledge of the earth.
COB 2: To help the students on the formation of land forms
COB 3: To impart the knowledge on different structures of the bed and their mechanism.
COB 4: To impart the knowledge on the formation of different rocks.
COB 5: To enable the students, learn the sedimentary structures in hand specimen.

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

CO 1: Explain the general facts of the earth.
CO 2: Analyze the different processes for the formation of land forms.
CO 3: Analyze the different structures like folds, faults etc.
CO 4: Compare and classify various kinds of rocks.
CO 5: Explain the process of transportation, generation of sedimentary 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)	PO11 (K4)
CO1 (K2)	2	-	-	-	-	2	2	1	-	-	-
CO2 (K2)	2	2	-	-	-	-	-	-	-	-	-
CO3 (K2)	2	2	1	-	-	-	-	-	-	-	-
CO4 (K3)	-	2	-	-	-	-	-	-	-	-	-
CO5 (K2)	2	2	-	2	1	-	2	-	-	2	1
CO6 (K2)	2	2	-	2	1	-	2	-	-	2	1

UNIT-I:
Origin and Evolution of Earth:
Dimensions of earth, structure, composition and origin of earth-envelops of the Earth- crust, mantle, core. Internal dynamic process- Plate tectonics- Continental drift, Earthquake and Volcanoes. External dynamic process – weathering-erosion-deposition.

UNIT-II:
Geomorphology:
Fundamental concepts in Geomorphology-geomorphic processes distribution of landforms-drainage patterns –development, Landforms in relation to rocks types, paleochannels, buried channels.

UNIT-III:
Structural Geology and Engineering Geology:
Classification of folds, faults and joints. Structural analysis of folds, cleavages, lineation’s, joints and faults, Mechanism of folding, faulting and progressive deformation.

UNIT-IV:

Petrology:

Origin of igneous, sedimentary and metamorphic rocks. Sedimentology - Sedimentary structures-petrographic characters of conglomerate, sandstone, shale, and limestone.

UNIT-V:

Sedimentology:

History and development of sedimentology. Liberation and flows of sediments, processes of transport and generation of mechanical, chemical and biogenic sedimentary structures and controls on the sedimentary rock record.

Text Books:

1. Engineering Geology,Bell, F.G., 2nd Edition, ButterworthHeimann,2007.
2. Text book of Geology, Mukherjee, P.K., The World Press Pvt. Ltd., 2005

Reference Books:

1. Elements of Mineralogy, Gribble, C. D., Rutley's, 27th Edition. CBS Publishers, 2005.
2. Principles of Physical Geology, David Duff, Homes, Nelson Thornes Ltd; 4thRevised edition, 1992.
3. Text book of Physical Geology, Mahapatra, G.B., CBS Publishers, 2002.
4. Principles of Engineering Geology, Bangar, K.M., 2nd Edition, Standard Publishers, 2009.

Web links:

1. web.crc.losrios.edu/~jacksoh/classes/earthscience/Chapter1.pdf
2. science.jrank.org/pages/3820/Landform.html
3. www.manitoba.ca/iem/min-ed/kidsrock/origins/index.html
4. https://ocw.mit.edu/courses/earth-atmospheric-and.../12...sedimentary.../ch11.pdf
5. www.ucmp.berkeley.edu/fosrec/ONeill.html

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HSE IN PETROLEUM INDUSTRY

(Open Elective)

III Semester	**L**	**T**	**P**	**C**
Course Code: 192PE3O06	**3**	**0**	**0**	**3**

Course Objectives:

COB 1: To impart knowledge on environmental issues associated with drilling and production operations.
COB 2: To enable the student to learn about impacts of drilling and production operations and waste tratment methods.
COB 3: To facilitate students learn about oil mines regulations.
COB 4: To impart knowledge on Hazop study, developing a safe process and safety management.
COB 5: To nurture the students about fires, firefighting equipment and suppression of hydrocarbon fires.

Course Outcomes:

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

CO 1: Explain the environmental issues in drilling and production operations.
CO 2: Summarize impacts of petroleum industry wastes and waste treatment methods.
CO 3: Demonstrate the oil mines regulations in various petroleum industry operations.
CO 4: Make use of the hazop study concepts for safe practices in Petroleum industry.
CO 5: Illustrate the fire triangle, different methods of suppression of hydrocarbon fires.

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	-	3	1	-	-
CO2 (K2)	3	3	-	-	-	-	-	-	-	-	-
CO3 (K3)	-	3	2	2	-	-	-	-	2	-	-
CO4 (K2)	2	-	-	-	3	-	-	-	-	-	-
CO5 (K3)	-	2	-	-	3	-	-	-	-	-	-

UNIT-I:

Introduction to Environmental Control in the Petroleum Industry: Overview of environmental issues- A new attitude.

Drilling and Production Operations: Drilling- Production- Air emissions.

UNIT-II:

The impact of drilling and Production Operations:

Measuring toxicity- Hydrocarbons-Salt-Heavy metals- Production chemicals-Drilling fluids- Produced water- Nuclear radiation- Air pollution- Acoustic impacts-Effects of offshore platforms- Risk assessment.

Environmental transport of Petroleum Wastes: Surface paths- Subsurface paths-Atmospheric paths, Planning for environmental protection.

Waste Treatment Methods: Treatment of water-Treatment of solids-Treatment of air emissions-Waste water disposal: surface disposal.

UNIT-III:

Oil mines Regulations:

Introduction-Returns, Notices and plans- Inspector, management and duties- Drilling and workover- Production- Transport by pipelines- Protection against gases and fires- Machinery, plants and equipment- General safety provisions-Miscellaneous- Remediation of contaminated sites- Site assessment-Remediation process.

UNIT-IV:

Hazard identification- Hazard evaluation- Hazop and what if reviews- Developing a safe process and safety management- Personal protection systems and measures.
Guidelines on internal safety audits (procedures and checklist) - Inspection & Safe practices during electrical installations- Safety instrumentation for process system in hydrocarbon industry- Safety aspects in functional training-Work permit systems.
Toxicity, physiological, asphyxiation, respiratory, skin effect of petroleum hydrocarbons and their mixture- Sour gases with their threshold limits -Guidelines for occupational health monitoring in oil and gas industry.

UNIT-V:

Classification of fires- The fire triangle- Distinction between fires and explosions-
Flammability characteristics of liquids and vapors- Well blowout fires and their control-
Fire fight equipment-Suppression of hydrocarbons fires.

Text Books:

1. Environmental Control in Petroleum Engineering, John C. Reis, Gulf Publishing Company, 1996.
2. Application of HAZOP and What if Reviews to the Petroleum, Petrochemical and Chemical Process Industries, Dennis P. Nolan, Noyes Publications, 1994.
3. Oil Industry Safety Directorate (OISD) Guidelines, Ministry of Petroleum &Natural Gas, Government of India and Oil Mines Regulations-1984, Directorate General of Mines Safety, Ministry of Labor and Employment, Government of India.

Reference Books:

1. Guidelines for Process Safety Fundamentals in General Plant Operations Centre for Chemical Process Safety, American Institute of Chemical Engineers, 1995.
2. Guidelines for Fire Protection in Chemical, Petrochemical and Hydrocarbon Processing Facilities, Centre for Chemical Process Safety, American Institute of Chemical Engineers, 2003.
3. Guidelines for Hazard Evaluation Procedures Centre for Chemical Safety, Wiley-
4. Guideline for Process Safety Fundamentals in General Plant Operations, Centre for Chemical Process Safety, AI Ch E, 1995.
5. Chemical Process Industry Safety, K S N Raju, McGraw Hill, 2014.

Web Links

1. https://onlinecourses.nptel.ac.in/noc18_oe04/preview
2. https://en.wikipedia.org/wiki/Hazard_and_operability_study