Program Structure for

B. E

Computer Science and Engineering

Scheme of Instruction and Syllabus

Scheme of Instruction & Examination
B. E. - Computer Science and Engineering

CSE Semester - I									
S. No.	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			Hours Per Week			**Duration in Hrs**	**Maximum Marks**		
			L	**T**	**P / D**		**CIE**	**SEE**	
Theory Courses									
1	3BS101HS	Engineering Mathematics - 1	3	1	0	4	40	60	4
2	3BS104HS	Applied Physics	3	1	0	4	40	60	4
3	3ES101CS	Programming for Problem Solving	3	0	0	3	40	60	3
4	3ES101EE	Elements of Electrical and Electronics Engineering	3	0	0	3	40	60	3
5	3MC101CE	Environmental Science	2	0	0	2	40	60	0
Practical / Laboratory Courses									
6	3BS151HS	Applied Physics Lab	0	0	3	3	25	50	1.5
7	3ES151CS	Programming for Problem Solving Lab	0	0	2	2	25	50	1
8	3ES151EE	Elements of Electrical and Electronics Engineering Lab	0	0	2	2	25	50	1
9	3ES151CE	Engineering Graphics Lab	1	0	4	5	50	50	3
		Total Credits				**28**	**325**	**500**	**20.5**

CSE Semester - II									
S. No.	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			Hours Per Week			**Duration in Hrs**	**Maximum Marks**		
			L	**T**	**P / D**		**CIE**	**SEE**	
Theory Courses									
1	3BS202HS	Engineering Mathematics – II	3	1	0	4	40	60	4
2	3BS206HS	Chemistry	3	1	0	3	40	60	4
3	3HS201HS	English	2	0	0	4	40	60	2
4	3ES202CS	Data Structures	3	0	0	3	40	60	3
Practical / Laboratory Courses									
5	3BS253HS	Chemistry Lab	0	0	3	3	25	50	1.5
6	3HS251HS	English Lab	0	0	2	2	25	50	1
7	3ES252CS	Data Structures lab	0	0	2	2	25	50	1
8	3ES252ME	Engineering Workshop Practice	1	0	4	5	25	50	2
9	3MC251SP	Yoga / NSS / Sports	0	0	2	2	50		0
		Total Credits				**28**	**260**	**490**	**18.5**

Scheme of Instruction & Examination
B. E. - Computer Science and Engineering

CSE Semester - III									
S. No.	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			L	**T**	**P / D**	**Contact Hours / week**	**CIE**	**SEE**	
Theory Courses									
1	3BS305HS	Probability and Statistics	3	1	0	4	40	60	4
2	3ES301EC	Switching Theory and Logic Design	3	0	0	3	40	60	3
3	3PC301CS	Database Management Systems	3	0	0	3	40	60	3
4	3PC302CS	Discrete Mathematics	3	0	0	3	40	60	3
5	3PC303CS	Computer Organization and Microprocessor	3	0	0	3	40	60	3
6	3MC302HS	Essence of Indian Traditional Knowledge	2	0	0	2	40	60	0
Practical / Laboratory Courses									
7	3PC351CS	Database Management Systems Lab	0	0	2	2	40	60	1
8	3PC352CS	Computer Organization and Microprocessor Lab	0	0	2	2	40	60	1
9	3PC353CS	Python Programming Lab	0	0	2*2	4	40	60	2
10	3PW354CS	Skill Development Course– I	0	0	2	2	40	60	1
		Total Credits				**28**	**400**	**600**	**21**

CSE Semester - IV									
S. No.	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			L	**T**	**P / D**	**Contact Hours / week**	**CIE**	**SEE**	
Theory Courses									
1	3HS404HS	Optimization and Problem Solving Techniques	3	0	0	3	40	60	3
2	3PC404CS	Data Mining	3	1	0	4	40	60	4
3	3PC405CS	Operating Systems	3	0	0	3	40	60	3
4	3PC406CS	Computer Networks	3	0	0	3	40	60	3
5	3HS403HS	Human Values Professional Ethics	2	0	0	2	40	60	2
Practical / Laboratory Courses									
6	3PC455CS	Operating Systems Lab	0	0	2	2	40	60	1
7	3PC456CS	Computer Networks Lab	0	0	2	2	40	60	1
8	3PC457CS	Java Programming Lab	0	0	2*2	4	40	60	2
9	3PW458CS	Skill Development Course– II	0	0	2	2	40	60	1
		Total Credits				**25**	**360**	**540**	**20**

Scheme of Instruction & Examination
B. E. - Computer Science and Engineering

CSE Semester - V									
S. No.	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			L	**T**	**P / D**	**Contact Hours / week**	**CIE**	**SEE**	
Theory Courses									
1	3PC507CS	Artificial Intelligence	3	1	0	4	40	60	4
2	3ES501CS	Digital Image Processing	3	0	0	3	40	60	3
3	3PC508CS	Software Engineering	3	0	0	3	40	60	3
4	3PE5(01 TO 05)CS	Professional Elective – I	3	0	0	3	40	60	3
5	OE	Open Elective – I	3	0	0	3	40	60	3
6	3MC503HS	Indian Constitution	3	0	0	3	40	60	0
Practical / Laboratory Courses									
7	3PC559CS	Artificial Intelligence Lab	0	0	2	2	40	60	1
8	3ES551CS	Digital Image ProcessingLab	0	0	2	2	40	60	1
9	3PW560CS	Skill Development Course–III	0	0	2	2	40	60	1
10	3HS553HS	Soft Skills Lab - I	0	0	2	2	40	60	1
		Total Credits				**27**	**400**	**600**	**20**

CSE Semester – VI									
S. No.	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			L	**T**	**P / D**	**Contact Hours / week**	**CIE**	**SEE**	
Theory Courses									
1	3PC609CS	Design and Analysis of Algorithms	3	0	0	3	40	60	3
2	3PC610CS	Machine Learning	3	0	0	3	40	60	3
3	3PC611CS	Automata Languages and Compiler Design	3	0	0	3	40	60	3
4	3PE6(06 TO 10) CS	Professional Elective – II	3	0	0	3	40	60	3
5	OE	Open Elective – II	3	0	0	3	40	60	3
6	3HS652HS	Effective Technical Communication(ETCE)	2	0	0	2	40	60	2
Practical / Laboratory Courses									
7	3PC661CS	Machine Learning Lab	0	0	2	2	40	60	1
8	3PC662CS	Web Technology Lab	0	0	2*2	4	40	60	2
9	3PW663CS	Mini Project	0	0	2	2	40	60	1
		Total Credits				**25**	**360**	**540**	**21**

Professional Elective - I

1	3PE501CS	Information Security
2	3PE502CS	Information Retrieval Systems
3	3PE503CS	Agile Methodologies
4	3PE504CS	Principles of Programming Languages
5	3PE505CS	DevOps

Professional Elective - II

1	3PE606CS	Digital Forensics
2	3PE607CS	Big Data Analytics
3	3PE608CS	Software Project Management
4	3PE609CS	Scripting Languages
5	3PE610CS	Natural Language Processing

Scheme of Instruction & Examination
B. E. - Computer Science and Engineering

CSE Semester - VII									
S. No.	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			L	**T**	**P / D**	**Contact Hours / week**	**CIE**	**SEE**	
Theory Courses									
1	3PC712CS	Cryptography and Network Security	3	0	0	3	40	60	3
2	3PC713CS	Deep Learning	3	1	0	4	40	60	4
3	3PC714CS	Cloud Computing	3	0	0	3	40	60	3
4	3PE7(11 TO 15) CS	Professional Elective – III	3	0	0	3	40	60	3
5	OE	Open Elective - III	3	0	0	3	40	60	3
Practical / Laboratory Courses									
6	3PC764CS	Cryptography and Network Security Lab	0	0	2	2	40	60	1
7	3PC765CS	Deep Learning Lab	0	0	2	2	40	60	1
8	3PW766CS	Project Work – I	0	0	4	4	40	60	2
9	3PW767CS	Summer Internship	-	-	-	-	40	60	2
		Total Credits				**24**	**360**	**540**	**22**

CSE Semester - VIII									
S. No.	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			L	**T**	**P / D**	**Contact Hours / week**	**CIE**	**SEE**	
Theory Courses									
1	3HS802HS	Managerial Economics and Financial Accounting	3	0	0	3	40	60	3
2	3PE8(16 TO 20)CS	Professional Elective – IV	3	0	0	3	40	60	3
3	3PE8(21 TO 25)CS	Professional Elective – V	3	0	0	3	40	60	3
Practical / Laboratory Courses									
4	3PW868CS	Project Work – II				16	50	100	8
		Total Credits				**25**	**170**	**280**	**17**

Professional Elective - III

1	3PE711CS	Mobile Computing
2	3PE712CS	Data Visualization
3	3PE713CS	Software Architecture and Design Patterns
4	3PE714CS	Full Stack Development I
5	3PE715CS	Digital marketing and E Commerce

Professional Elective - V

1	3PE821CS	Adhoc Sensor Networks
2	3PE822CS	Nature Inspired Computing
3	3PE823CS	Software Testing Methodologies
4	3PE824CS	Full Stack Development II
5	3PE825CS	Semantic Web and Social Networks

Professional Elective – IV

1	3PE816CS	Ethical Hacking
2	3PE817CS	Web Mining
3	3PE818CS	Software Requirements and Estimations
4	3PE819CS	Web and Social Media Analytics
5	3PE820CS	Blockchain Technology

DEPARTMENT OF CSE – CREDIT STRUCTURE

Category	Sem - I	Sem - II	Sem - III	Sem - IV	Sem - V	Sem - VI	Sem - VII	Sem - VIII	Total
HS		3		5	1	2		3	**13**
BS	9.5	9.5	4						**23**
ES	11	6	3		0				**20**
PC			13	14	12	12	12		**64**
PE					3	3	3	6	**15**
OE					3	3	3		**9**
PW			1	1	1	1	4	8	**16**
MC	ES	Yoga/ NSS/ Sports	EITK		COI				
Total	**20.5**	**18.5**	**21**	**20**	**20**	**21**	**22**	**17**	**160**

LIST OF PROFESSIONAL ELECTIVES

S. No.	Networks/ Security	Data Science and Machine Intelligence	Software and Technology	Web Applications	Emerging Technologies
1	Information Security	Information Retrieval Systems	Agile Methodologies	Principles of Programming Languages	Dev Ops
2	Digital Forensics	Big Data Analytics	Software Project Management	Scripting Languages	Natural Language Processing
3	Mobile Computing	Data Visualization	Software Architecture and Design Pattern	Full Stack Development I	Digital marketing and E Commerce
4	Ethical Hacking	Web Mining	Software Requirements and Estimation	Web and Social Media Analytics	Blockchain Technology
5	Adhoc Sensor Networks	Nature Inspired Computing	Software Testing Methodologies	Full Stack Development II	Semantic Web and Social Networks

OPEN ELECTIVES OFFERED BY CSE to OTHER DEPARTMENTS

Open Elective - I

1	3OE501CS	OOPS Using Java

Open Elective - II

1	3OE602CS	Software Engineering

Open Elective - III

1	3OE703CS	Human Computer Interaction

Open Elective – IV

1	3OE804CS	Data Science

SYLLABUS

B. E. - Computer Science and Engineering

CSE Semester - III									
S. No.	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			L	**T**	**P / D**	**Contact Hours / week**	**CIE**	**SEE**	
Theory Courses									
1	3BS305HS	Probability & Statistics	3	1	0	4	40	60	4
2	3ES301EC	Switching Theory and Logic Design	3	0	0	3	40	60	3
3	3PC301CS	Database Management Systems	3	0	0	3	40	60	3
4	3PC302CS	Discrete Mathematics	3	0	0	3	40	60	3
5	3PC303CS	Computer Organization and Microprocessor	3	0	0	3	40	60	3
6	3MC302HS	Essence of Indian Traditional Knowledge	2	0	0	2	40	60	0
Practical / Laboratory Courses									
7	3PC351CS	Database Management Systems Lab	0	0	2	2	40	60	1
8	3PC352CS	Computer Organization and Microprocessor Lab	0	0	2	2	40	60	1
9	3PC353CS	Python Programming Lab	0	0	2*2	4	40	60	2
10	3PW354CS	Skill Development Course-I	0	0	2	2	40	60	1
		Total Credits				**28**	**400**	**600**	**21**

Course Code	Course Title						Core / Elective
3BS305HS	PROBABILITY & STATISTICS						BS
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	-	-	40	60	4

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To study theconceptsof Probability and random variables
2. To provide the knowledge of discrete probability Distributions
3. To learn theoretical continuous probability distributions.
4. To provide the knowledge of correlation and regression.
5. To learn the concept of small sample tests and curve fitting

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. To understand concepts of probability and random variables
2. Apply various probability distributions to solve practical problems, to estimate unknown parameters of populations
3. Find Mean, variance, moment generating function and statistical parameters of continuous probability distributions
4. To perform a regression analysis and to compute and interpret the coefficient of correlation
5. Evaluate t-distribution, F-distribution and chi-square distributions. Fitting of straight line, parabola and exponential curves.

UNITI

Introduction of Probability, Conditional probability, Theorem of Total probability, Bayes' Theorem and its applications, Random variables, Types of random variables, Probability mass function and Probability density function, Mathematical expectations.

UNITII

Discrete probability distributions: Binomial and Poisson distributions, Mean, variance, moment generating function and evaluation of statistical parameters for these distributions, Moments, skewness and Kurtosis.

UNITIII

Continuous probability distributions, Uniform, Exponential and Normal distributions, Mean, variance, moment generating function and evaluation of statistical parameters for these distributions

UNITIV

Correlation, regression and Rank correlation. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

UNITV

t-Test for single mean, difference of means, f-test for ratio of variances, Chi-square test for goodness of fit and independence of attributes. Curve fitting by the method of least squares: fitting of straight lines, second degree parabolas and more general curves,

TEXT BOOKS

1. Higher.EngineeringMathematics,Dr.B.S. Grewal, KhannaPublications,Forty-Three Edition,2014. (unit 1-5)
2. Advance Engineering Mathematics,R.K.Jain and Iyengar,Fifth Edition, NarosaPublications (unit 1-5)
3. EngineeringMathematics,P.Sivaramakrishna Das & C. Vijaya Kumar,Pearson India Education Services Pvt.Ltd.

REFERENCE BOOKS

1. Fundamentals of Mathematical Statistics, S.C.Gupta&V.K.Kapoor, S.Chand Pub.

2. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 1968

Course Code	Course Title						Core / Elective
3ES301EC	SWITCHING THEORY AND LOGIC DESIGN						ES
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To understand basic number systems, codes and logical gates.
2. To understand the concepts of Boolean algebra & use of minimization logic to solve the Boolean logic expressions.
3. To understand the design of combinational and sequential circuits.
4. To understand HDL
5. To understand the state reduction methods for sequential circuits.
6. To understand the basics of various types of memories

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Able to understand number systems and codes.
2. Able to solve Boolean expressions using Minimization methods.
3. Able to design the combinational circuits and understand HDL
4. Able to write code for various gates and combinatorial logic circuits
5. Able to apply state reduction methods to solve sequential circuits.
6. Able to design memories using PLDs

UNITI

Binary Systems, Boolean algebra and Logic Gates.

DigitalSystems. Binary Numbers. Number Base Conversions. Octal and Hexadecimal Numbers. Complements. Signed Binary Numbers. Binary Codes. Binary Storage and Registers Binary logic.

UNITII

Basic Definitions. Axiomatic Definition of Boolean algebra. Basic Theorems and Properties of Boolean Algebra. Boolean Functions. Canonical and Standard Forms. Other logic Operations. Digital Logic Cates.

Gate Level Minimization: The K Map Method. Four-Variable Map, Five-Variable Map Product of Sums Simplification. Don't-Care Conditions.

UNIT III

Combinational Logic Design

NAND and NOR Implementation. Other Two- Level Implementations. Exclusive-OR Function. Hardware Description Language (HDL,), HDL for logic gates.

Combinational circuits. Analysis Procedure , Design Procedure , Binary Adder, Subtractor ,Decimal Subtractor , Binary Multiplier , Magnitude comparator, Decoders , Encoders , Multiplexers ,HDL For Combinational circuits

UNIT IV

Sequential Logic Design, Synchronous Sequential Logic

Sequential Circuits: Latches, Flip-Flops. Analysis of Clocked Sequential Circuits, HDL for Sequential Circuits. State Reduction and Assignment Design Procedure.

Registers ad Counters.

Registers, Shift Registers, Ripple Counters. Synchronous Counters. Other Counters. HDL for Registers and Counters

UNIT V

Memory and Programmable Logic: Introduction to Random Access Memory, Memory Decoding, Error Detection and Correction, Read only Memory, Programmable Logic Array, Programmable Array Logic Devices, Sequential Programmable Devices.

TEXTBOOKS

l. Digital Design, 3rd Edition, M. Morris Mano, Pearson Education, Inc,, 2002
2. A.k .Singh. “Foundation of Digital Electronics and Logic design". New Age international'
3. Fundamentals of Digital Circuits, A. Anand Kumar, PHI, 2002
4. Rajaraman&Radhakrishnan, "Digital Logic and Computer Organization". PHI Learning Private limited, Delhi India.
5. ZVI Kohavi. "Switching and finite Automata theory”, Tata McGraw-hill.

Course Code	Course Title						Core / Elective
3PC301CS	DATABASE MANAGEMENT SYSTEMS						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. To get familiar with fundamental concepts of database management which includes database design, database languages, and database-system implementation.
2. To get familiar with data storage techniques and indexing.
3. To impart knowledge in transaction Management, concurrency control techniques and recovery techniques.
4. To master the basics of SQL and construct queries using SQL.
5. To become familiar with database storage structures and access techniques

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Develop the knowledge of fundamental concepts of database management and Designing a database using ER modelling approach.
2. Implement storage of data, indexing, and hashing.
3. Apply the knowledge about transaction management, concurrency control and recovery of database systems.
4. Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data
5. Apply the knowledge to retrieve database from multiple table using Sql and Pl/sql

UNITI

Introduction to Database and System Architecture: Database Systems and their Applications, Database Vs File System, View of Data, Data Models, Database Languages- DDL and DML, Transaction Management, Database users and Administrators, Database System Structure. Introduction to Database Design: ER Diagrams, Entities, Attributes and Entity sets, Relationships and Relationship set, Extended ER Features, Conceptual Design with the ER Model, Logical database Design.

UNITII

SQL Queries and Constraints: SQL Data Definition, Types of SQL Commands, Form of Basic SQL Query, SQL Operators, Set Operators, , Aggregate Operators, NULL values ,Functions, Integrity Constraints Over Relations, Joins, Nested Queries, Introduction to Views, Destroying / Altering Tables and Views, PL/SQL Functions and Stored procedures ,Cursors, Triggers and Active Databases.

UNIT III

Relational Model: Introduction to Relational Model, Basic Structure, Database Schema, Keys, Relational Algebra and Relational Calculus. Storage and Indexing: File Organizations and Indexing-Overview of Indexes, Types of Indexes, Index Data Structures, Tree structured Indexing, Hash based Indexing.

UNIT IV

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies, Reasoning about FD, Normal Forms and Normalization: INF,2NF,3NF, BCNF,4NF,5NF, Properties of Decomposition

UNIT V

Transaction Management: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability. Concurrency Control: Lock based Protocols, Timestamp based protocols, Recovery System: Recovery and Atomicity, Log based recovery, Shadow Paging, Recovery with concurrent Transactions, Buffer Management.

TEXTBOOKS

1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, III Edition, Tata McGraw Hill 2002.
2. Data base System Concepts, Silberschatz, Korth, V Edition, McGraw Hill, 2005.
3. Introduction to Database Systems, C.J.DatePearsonEducation, 2006.
4. Database Systems design, Implementation, and Management, Rob &Coronel, V Edition, 2007.

REFERENCE BOOKS

1. Database Management System, ElmasriNavate, PearsonEducation, 7th Edition, 2008.
2. Database Management System, Alexis Leon, Mathews Leon, Tata McGraw Hill Education, 2008.

Course Code	Course Title						Core / Elective
3PC302CS	DISCRETE MATHEMATICS						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To understand the concepts of Logic, Rules of inference and Quantifiers
2. To explain with examples, the basic terminology of functions, relations, and sets.
3. To impart the knowledge on Groups, Normal subgroups, Rings and Field
4. To relate the ideas of mathematical induction to recursion and recursively defined structures.
5. To develop Graph Algorithms by using the concepts of Graphs and Trees

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Apply mathematical logic to solve problems
2. Illustrate by examples the basic terminology of functions, relations, and sets and demonstrate knowledge of their associated operations.
3. Identify structures of algebraic nature and apply basic counting techniques to solve combinatorial problems.
4. Formulate problems and solve recurrence relations.
5. Apply Graph Theory in solving computer science problems

UNIT I

Mathematical Logic: Statements and notations, Connectives, Well-formed formulas, Truth Tables, tautology, equivalence implication, Normal forms, Quantifiers, universal quantifiers.

Predicates: Predicative logic, Free & Bound variables, Rules of inference, Consistency, proof ofcontradiction, Automatic Theorem Proving

UNIT II

Set Theory and Relations: Basic Concepts of Set Theory, Relations and Ordering,Properties of Binary Relations, equivalence, transitive closure, compatibility and partial ordering relations Hasse Diagram.

Functions: Composition of functions, Inverse Functions, Recursive Functions, Lattice and its Properties

UNIT III

Algebraic structures: Algebraic Systems-Examples and General Properties, Semi groups and Monoids, groups, sub groups, homomorphism, Isomorphism, Fields, Rings, Integral domains

Elementary Combinatorics: Basis of counting, Combinations & Permutations, with repetitions,Constrained repetitions, Binomial Coefficients, Binomial Multinomial theorems, the principles ofInclusion – Exclusion. Pigeon hole principles and its application.

UNIT IV

Recurrence Relations: Recurrence Relations, Solving Linear Recurrence Relations,Divide-and-Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion-Exclusion, Applications of Inclusion-Exclusion.

UNIT V

Graphs: Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring.

Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees.

TEXT BOOKS

1. Discrete Mathematics and its Applications, Kenneth H. Rosen, Fifth Edition, McGraw Hill Education, 2017.
2. Elements of Discrete Mathematics- A Computer Oriented Approach- C L Liu, D PMohapatra. Third Edition, Tata McGrawHill, 2017.
3. Discrete Mathematics for Computer Scientists & Mathematicians, J.L. Mott, A. Kandel,T.P. Baker,Second Edition, PHI, 2015.

REFERENCE BOOKS

1. Discrete Mathematical Structures Theory and Application- Malik & Sen,First Edition,Cengage Learning, 2012.
2. Discrete Mathematics with Applications, Thomas Koshy, First Edition, Elsevier, 2005.

Course Code	Course Title						Core / Elective
3PC303CS	COMPUTER ORGANIZATION AND MICROPROCESSOR						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. To explore the I/O organizations in depth.
2. To learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design.
3. To be familiarized with the hardware components and concepts related to the memory organization.
4. To be familiarized with the hardware components and concepts related to the input-output organization
5. Understand the concepts and applications of Internet of Things, Building blocks of Internet of Things and characteristics

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Recall and apply a basic concept of block diagram of computer (CPU) with Microprocessor processor UNIT (MPU)
2. Understand the internal architecture and register organization of 8086
3. Apply knowledge and demonstrate programming proficiency using the various addressing modes and instruction sets of 8086
4. Identify and compare different methods for computer I/O mechanisms
5. Categorize memory organization and explain the function of each element of a memory hierarchy

UNIT I

Basic Computer Organization: Functions of CPU, I/O UNITs, Memory: Instruction: Instruction Formats- One address, two addresses, zero addresses and three addresses and comparison; addressing modes with numeric examples: Program Control- Status bit conditions, conditional branch instructions, Program Interrupts: Types of Interrupts

UNIT II

8086 CPU Pin Diagram: Special functions of general purpose registers, Segment register, concept of pipelining, 8086 Flag register, Addressing modes of 8086

Pipelining: Introduction, processors, performance, hazards, super scalar operations and performance considerations

UNIT III

8086-Instruction formats: assembly Language Programs involving branch & Call instructions, sorting, evaluation of arithmetic expressions.

UNIT IV

Input-Output Organizations I/O Vs Memory Bus, Isolated Vs Memory-Mapped I/O, Asynchronous data Transfer Techniques, Asynchronous Serial transfer- Asynchronous Communication interface (8251), Modes of transfer Programmed I/O, Interrupt Initiated I/O, DMA; DMA Controller (8257), IOP-CPU-IOP Communication, Intel 8089 IOP

UNIT V

Memory Organizations: Memory hierarchy, Main Memory, RAM, ROM Chips, Memory Address Map, Memory Connection to CPU, associate memory, Cache Memory, Data Cache,
Instruction cache, Miss and Hit ratio, Access time, associative, set associative, mapping, waiting into cache, Introduction to virtual memory

TEXTBOOKS

1. Computer system Architecture: Morris Mano, Third Edition,Pearson Education, 2017.
2. Computer Organization and Architecture–William Stallings, Sixth Edition, Pearson/PHI, 2002.
3. Advanced Micro Processor and Peripherals, K Bhurchandi (Author), A. K. Ray (Author), 2017.

REFERENCE BOOKS

1. Computer Organization V. Carl Hamacher, Safwat G. Zaky, ZvonkoVranesic, Zvonko G Vranesic,Fifth Edition,McGraw-Hill Higher Education, 2001.
2. Microprocessor Architecture, Programming, Applications with 8085, Ramesh S Gaonkar, Fifth Edition, Prentice Hall,2002.

Course Code	Course Title						Core / Elective
3MC302HS	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE						MC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	2	-	-	-	40	60	-

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To reinforce the students understanding with the Pan-Indian heritage in terms of culture, traditions and knowledge.
2. To impart understanding of the importance of the roots of the traditional knowledge and types.
3. To impart basic knowledge on the evolution of the multiple languages that highlight India's diversity.
4. To know Indian Languages,Philosophies, Religion, Literature, Fine arts and Technology.
5. To explore the Ancient Science, Scientists, in Medieval and Modern India; the education system.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand the concepts of Indian culture and Traditions and their importance.
2. Distinguish the Indian languages and literature
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India
5. Know the contribution of scientists of different eras, interpret the concepts and the importance to protect Intellectual property of the nation.

UNIT I

Dawn of human civilization and evolution of various cultures, Introduction to Culture: Civilization, Culture and heritage,General characteristics of culture, importance of culture in human literature,Indian Culture, Ancient India, Medieval India, Modern India

UNIT II

Indian Languages, Culture and Literature: Indian Languages and Literature-I: the evolution and role of Sanskrit, significance of scriptures to current society -Indian philosophies, other Sanskrit literature, literature of south India. Indian Languages and Literature-II: -Northern Indian languages & literature

UNIT III

Religion and Philosophy: -Religion and Philosophy in ancient India -Religion and Philosophy in medieval India -Religious reform movements in modern India (selected movements only)

UNITIV

Fine Arts in India (Art, Technology& Engineering): -Indian Painting, Indian handicrafts, Music: Divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern),Science and Technology in India: development of science in ancient, medieval and modern India. Their relation in terms of modern scientific perspective, Protection of traditional knowledge, significance, value to economy, role of government in protection of indigenous knowledge and technology, protection of traditional knowledge bill, 2016.

UNIT V

Education System in India: Education in ancient, medieval and modern India,Aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TEXTBOOKS

1. Indian Knowledge Systems (2 Vols-Set), Kapil Kapoor and Avadhesh KumarSingh; ISBN 10: 8124603367 / ISBN 13: 9788124603369, Published by D K Printworld, Publication Date: 2007
2. Science in Samskrit, SamskritaBharati, Published by SamskritaBharati, NewDelhi, India, 2007; ISBN 10: 8187276339 / ISBN 13: 9788187276333.
3. Traditional Knowledge System and Technology in India, Book by Basanta KumarMohanta and Vipin K. Singh, originally published: 2012 Publication Date: 2012;ISBN 10: 8177023101ISBN 13: 9788177023107.
4. 1.7-Position paper, National Focus Group on Arts, Music, Dance and TheatreNCERT, March 2006, ISBN 81-7450-494-X, NCERT, New Delhi, 2010.
5. Indian Art and Culture, 4th Edition, By Nitin Singhania, ISBN:9354601804 · 9789354601804, © 2022 | Published: December 20, 2021
6. 'Education and Examination Systems in Ancient India, written/authored/edited byS. Narain', published 2017, English-Hardcover, ISBN 9789351282518 publisher:Kalpaz Publications.
7. Satya Prakash, Founders of Sciences in Ancient India, Vijay Kumar Publisher, NewDelhi, 1989
8. M. Hiriyanna, Essentials of Indian Philosophy, MotilalBanarsidass Publishers, New Delhi, 2005

Course Code	Course Title						Core / Elective
3PC351CS	DATABASE MANAGEMENT SYSTEMS LAB						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To practice various DDL, DML commands in SQL
2. To write simple and Complex queries in SQL
3. To practice various Functions, Joins &sub queries in SQL
4. To write PL/SQLusing cursors and collections
5. To write PL/SQL using Stored Procedures

COURSE OUTCOMES:

After the completion of course the students will be able to:

1.Design and implement a database schema for a given problem
2.Develop the query statements with the help of structured query language.
3.Populate and query a database using SQL and PL/SQL
4.Develop multi-user database application
5.Design and implement E-R model for the given requirements

List of Programs:

1. Creation of database Tables (exercising the all SQL commands)
2. Simple and complex condition query creation using SQL Plus
3. Creation of database Tables using Integrity constraints and Functions
4. Simple and complex condition query creation using Joins
5. Simple and complex condition query creation using Sub queries and set operators
6. Creation of Views (exercising the all types of views)
7. Writing PL/SQL function and cursors
8. Writing PL/SQL stored procedure and triggers
9. Creation of Forms and reports for student Information, library information, Pay roll etc.
10. Case Study: Design Database for Bank
    => Collect the information Related with Bank organization
    => Draw E-R Diagrams for Bank
    => Reduce E-R Diagrams to tables
    => Normalize your Database up to 3rd Normal form
    => Retrieve Bank information using SQL commands

Course Code	Course Title						Core / Elective
3PC352CS	COMPUTER ORGANIZATION AND MICROPROCESSOR LAB						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. Provide practical hands on experience with Assembly Language Programming.
2. Familiar with the architecture and Instruction set of Intel 8086 microprocessor.
3. Familiarize the students with interfacing of various peripheral devices with 8086 microprocessors.
4. Identify a detailed s/w & h/w structure of the Microprocessor.
5. Develop the programs for microprocessor based applications.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Interpret the principles of Assembly Language Programming, instruction set in developing microprocessor based applications
2. Develop Applications such as:8-bit Addition, Multiplication, and Division, array operations, swapping, negative and positive numbers.
3. Build interfaces of Input-output and other units
4. Understand working of instruction set and addressing modes
5. Analyze the function of traffic light controller

List of Programs:

1. Tutorialswith8086kit/MASMsoftwaretool. (Data transfer instructions)
2. Arithmetic operations
3. Addressing modes
4. Branch instructions
5. Logical instructions
6. Searching.
7. Sorting
8. Displayastringofcharactersusing8279.
9. Interfacingseven-segmentLEDusing8255.
10. A case study on trafficlight signal controller.

TEXTBOOKS

1. Advanced Micro Processor and Peripherals, K Bhurchandi (Author), A. K. Ray (Author), 2017.
2. Microprocessor Architecture, Programming, Applications with 8085, Ramesh S Gaonkar, Fifth Edition, Prentice Hall,2002.

Course Code	Course Title						Core / Elective
3PC353CS	PYTHON PROGRAMMING LAB						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	4	40	60	2

COURSE OBJECTIVES:

The objective of this course is to make the student to

1.To learn how to design and program using lists, tuples, and dictionaries.
2.To learn how to use indexing and slicing to access data in Python programs.
3.To learn structure and components of a Python and to read and write files.
4.To learn how to design object-oriented programs with Python classes and Exception handling techniques.
5.To learn how to design and build the GUI applications using python.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1.Develop solutions to simple computational problems using Python programs.
2.Solve problems using conditionals and loops in Python.
3.Develop Python programs by defining functions and calling them.
4.Use Python lists, tuples and dictionaries for representing compound data.
5.Develop Python programs for GUI applications

ListofPrograms

1. Develop program to demonstrate different number datatypes in python
2. Develop program to understand the control structures of python
3. Develop program on String manipulation
4. Develop program to perform various operations on files
5. Develop programs to learn different types of structures (list, dictionary, tuples) in python
6. Develop programs to learn concept of functions scoping, recursion and list mutability
7. Develop program to demonstrate classes and OOP principles
8. Develop programs to understand working of exception handling and assertions
9. Develop event driven GUI programs
10. Explore different debugging methods in Python: A Case Study

TEXTBOOKS

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2nd Edition, 2017, Cengage Learning

2. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India

REFERENCE BOOKS / LINKS

1. Mark Summerfield. ―Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist,,,,, 2nd edition, Updated for Python 3, Shroff/O,,Reilly Publishers, 2016
3. NPTEL Course, Programming, Data Structures and Algorithms using Python, Link: https://nptel.ac.in/courses/106106145
4. NPTEL Course, The Joy of Computing using Python, Link: https://nptel.ac.in/courses/106106182
5. FOSSEE, Python,Link: https://python.fossee.in/

SKILL DEVELOPMENT COURSE-I

Semester III	**L**	**T**	**P**	**Credits**
Subject code – 3PW354CS	**0**	**0**	**2**	**1**

Guidelines for Evaluation of Skill Development

1. Continuous Evaluation method is adopted for skill development courses of all semesters and 40 marks are allocated for CIE.
   At the end of each module, the student isevaluated by allocating marks as given under.
   Observation : 10 marks
   Continuous Performance and Execution : 20 marks
   Viva-Voce : 10marks
   Average of marks obtained in all experiments is considered as the marksobtained in CIE

2. The Semester End Examination shall be conducted with an external examinerand the internal examiner for 60 marks. The external examiner shall be appointed bythe Principal from the panel of examiners recommended by Controller of Evaluation andBoard of Studies.
   Quiz/ Skill Test/Assignment/ Mini Project : 40 marks
   Viva-Voce : 20 marks

Course Code	Course Title						Core / Elective
3PW354CS	CISCO INTRODUCTION TO INTERNET OF THINGS (IoT)						PW
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student to

1.Learn how digital transformation turns information into action, creating unprecedented economic opportunity.
2.Understand how the IoT brings together operational technology and information technology systems.
3.Discover how business processes for evaluating and solving problems are being transformed.
4.Learn the security concerns that must be considered when implementing IoT solutions.
5.Practice what you learn using Cisco Packet Tracer, a network configuration simulation tool

COURSE OUTCOMES:

After the completion of course the students will be able to:

1.Explain the meaning and impact of Digital Transformation.
2.Apply basic programming to support IoT devices.
3.Explain how data provides value to Digital Business and Society.
4.Explain the benefits of automation in the digitized world.
5.Explain the need for enhanced security in the digitized world and discover opportunities provided by digital transformation

MODULE 1: Everything is Connected

Digital Transformation: Explain how digital transformation affects business, industry, and our daily lives, explain how digital transformation enables innovation, explain how networks provide the platform for Digital Business and society.
Devices that Connect to the IoT: Configure an IoT device to connect to the network, describe the exponential growth of connected IoT devices, configure devices to communicate in the IoT

MODULE 2: Everything Becomes Programmable

Apply Basic Programming to Support IoT Devices: Use Python to create programs that accept user input and read and write to external files, Describe basic programming variables and fundamentals. Apply basic programming variables and fundamentals in Blockly. Apply basic programming variables and fundamentals using Python
Prototyping Your Idea: Explain prototyping and its purpose,Describe Prototyping, Describe the various tools and materials to use to prototype.

MODULE 3: Everything Generates Data

Big Data: Explain the concept of Big Data, Describe the sources of Big Data, Explain the challenges and solutions to Big Data storage, Explain how Big Data analytics are used to support Business.

MODULE 4: Everything Can be Automated

What Can be Automated?: Explain how digitization allows business processes to embrace automation, Describe automation Explain how artificial intelligence and machine learning impact automation. Explain how intent-based networking adapts to changing business needs.

MODULE 5: Everything Needs to be Secured

Security in the Digitized World: Explain why security is important in the digitized world. Explain the need for security in the digitized world, explain how to help secure the corporate world, and explain how to secure personal data and devices.

REFERENCES

1. Introduction to IoT by CISCO Network Academy, Version 2.0,July 2018

B. E. - Computer Science and Engineering

CSE Semester - IV									
S. No.	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			L	**T**	**P / D**	**Contact Hours / week**	**CIE**	**SEE**	
Theory Courses									
1	3HS404HS	Optimization & Problem Solving Techniques	3	0	0	3	40	60	3
2	3PC404CS	Data Mining	3	1	0	4	40	60	4
3	3PC405CS	Operating Systems	3	0	0	3	40	60	3
4	3PC406CS	Computer Networks	3	0	0	3	40	60	3
5	3HS403HS	Human Values Professional Ethics	2	0	0	2	40	60	2
Practical / Laboratory Courses									
6	3PC455CS	Operating Systems Lab	0	0	2	2	40	60	1
7	3PC456CS	Computer Networks Lab	0	0	2	2	40	60	1
8	3PC457CS	Java Programming Lab	0	0	2*2	4	40	60	2
9	3PW458CS	Skill Development Course- II	0	0	2	2	40	60	1
		Total Credits				**25**	**360**	**540**	**20**

Course Code	Course Title						Core / Elective
3HS404HS	OPTIMIZATION & PROBLEM SOLVING TECHNIQUES						HS
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. Prepare the students to have the knowledge of Linear Programming Problem in operations.
2. Study Economic Interpretation, Post optimal of sensitivity analysis
3. Use variables for formulating complex mathematical models in management science, industrial engineering and transportation models.
4. Make students understand the concept replacement models.
5. Prepare the students to understand the theory of Game in operations research

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Solve Linear Programming Problems by various methods
2. Finding relationship between primal and dual solution, Economic Interpretation Research.
3. Understand the mathematical tools that are needed to solve optimization problems like Transportation models
4. Understand the Assignment models, replacement models with change in money value considering with time and without time.
5. Understand the theory of Game in operations research at the end students would able to explain applications of Game theory in decision making for conflict

UNIT I

Introduction: Definition and scope of operations Research.

Linear Programming: Introduction, Formulation of Linear programming problem, graphical method of solving LP problem, simplex method, maximization and minimization, Degeneracy in LPP, Unbounded and, Infeasible solutions.

UNIT II

Duality: Definition, Relationship between primal and dual solution, Economic Interpretation, Post optimal of sensitivity analysis, Dual simplex method.

UNIT III

Transportation Models: Finding an initial feasible Solution-North West corner method, least cost method, Vogel's Approximation method, Finding the optimal solution, optimal solution by stepping

stone and MODI methods, special cases in Transportation Problems-Unbalanced Transportation problem**.**

UNIT IV

Assignment Problems: Hungarian Method of Assignment problem, Maximization in Assignment problem, unbalanced problem, problems with restrictions, travelling salesman problems.
Replacement models: Introduction, replacement of items that deteriorate ignoring change in money value, replacement of items that deteriorate considering change in money value with time, replacement of items that fail suddenly- Individual replacement policy, Group replacement policy.

UNIT V

Game Theory: Introduction, 2 person zero sum games, Maximin – Minimax principle of Dominance, Solution for mixed strategy problems, Graphical method for $2\times n$and m×2 games.

Sequencing Models: Introduction, General assumptions, processing n jobs through 2 machines, rocessing 'n' jobs through m machines, Processing 2 jobs through m machines.

TEXTBOOKS

1. Hamdy,A.Taha,"OperationsResearch-AnIntroduction",SixthEdition,PrenticeHallofIndiaPvt.Ltd.,1997.
2. S.D Sharma, Operations Research, Kedarnath, Ramnath& Co., Meerut,2009
3. J.B.Gupta,UtilizationofElectricPowerandElectricTraction,S.K.Kataria&SonsPublications ,2010.
4. HarveyM.Wagner,Principles ofOperationsResearch,SecondEdition,PrenticeHallofIndia Ltd.,1980.
5. V.K.Kapoor,OperationsResearch,S.ChandPublishers,NewDelhi,2004
6. R.PaneerSelvam,OperationsResearch,SecondEdition,PHILearningPvt.Ltd,2008.

Course Code	Course Title						Core / Elective
3PC404CS	DATA MINING						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	-	-	40	60	4

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. Introduce the basic concepts of Data Warehouse and Data Mining
2. Introduce current trends in data mining
3. Identify data mining problems and implement the data warehouse
4. Write association rules for a given data pattern.
5. Choose between classification and clustering solution

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand the principles of Data Warehousing and Data Mining.
2. Implementing data warehouse architecture and its applications.
3. Organize and prepare the data needed for data mining using preprocessing techniques
4. Implement the appropriate data mining methods like classification, association and clustering on a given data set.
5. Understanding the importance of data mining application and using the most appropriate approach for the realistic strategy

UNIT I

Data Warehousing & Modeling:

Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.

UNIT II

Data warehouse implementation& Data mining: Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP.

Introduction: What is data mining, Challenges, Data Mining Tasks.

Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity.

UNIT III

Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.

UNIT IV

Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

UNIT V

Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

TEXTBOOKS

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression,2014.
2. Jiawei Han, MichelineKamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012.

REFERENCE BOOKS

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson, Tenth Impression,2012.
2. Michael. J. Berry, Gordon. S. Linoff: Mastering Data Mining, Wiley Edition, second edtion,2012.

Course Code	Course Title						Core / Elective
3PC405CS	OPERATING SYSTEMS						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To learn the fundamentals of Operating Systems.
2. To learn the mechanisms of OS to handle processes and threads and their communication.
3. To learn the mechanisms involved in memory management in contemporary OS.
4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection.
5. To know the components and management aspects of concurrency management

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Describe the concepts of OS structure and Process synchronization
2. Evaluate and design different process scheduling algorithms
3. Identify the rationale behind various memory management techniques along with issues and challenges of main memory and virtual memory
4. Compare different file allocation methods and decide appropriate file allocation strategies
5. Describe the mechanisms available is OS to control access to resources and provide system security.

UNIT I

Introduction: Concept of Operating Systems, Generations of Operating systems, Types ofOperating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic,MicrokernelOperatingSystems, Concept ofVirtual Machine.

UNITII

Processes: Definition,ProcessRelationship,DifferentstatesofaProcess,ProcessStatetransitions,Process Control Block (PCB), Contextswitching

Thread: Definition,Variousstates,Benefitsofthreads,Typesofthreads,Conceptofmultithreads,

ProcessScheduling: FoundationandSchedulingobjectives,TypesofSchedulers,SchedulingCriteria, Schedulingalgorithms, multiprocessor scheduling

UNITIII

Process Synchronization: Inter-process Communication: Critical Section, Race Conditions,MutualExclusion,Peterson'sSolution,classicalproblemsofsynchronization:TheBounde d bufferproblem,Producer\ConsumerProblem,reader's&writerproblem,Dinningphilosopher'sproble m.Semaphores,EventCounters,Monitors,MessagePassing,

Deadlocks: Definition,NecessaryandsufficientconditionsforDeadlock,MethodsforHandling:Deadlocks:Deadl

ockprevention,DeadlockAvoidance:Banker'salgorithm,Deadlockdetection andRecovery.

UNIT IV

MemoryManagement: Basicconcept,LogicalandPhysicaladdressmap,Memoryallocation: Contiguous Memory allocation, fragmentation and Compaction; Paging: Principleofoperation–Pageallocation–Hardwaresupportforpaging,structureofpagetable,Protectionand sharing, Disadvantages of paging.
Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality ofreference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacementalgorithms,Trashing

UNIT V

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/OSoftware:GoalsofInterrupthandlers,Devicedrivers,DeviceindependentI/O software,
File Management: Concept of File, Access methods, File types, File operation, Directorystructure,FileSystemstructure,Allocationmethods,Free-spacemanagement,directoryimplementation,efficiencyand performance.
Secondary-Storage Structure: Disk structure, Disk scheduling algorithms, Disk Management, RAID structure

TEXTBOOKS

1. Abraham Silberschatz, Peter B Galvin, Greg Gagne, Operating System Concepts Essentials, 9th Edition, Wiley Asia Student Edition, 2017.
2. William Stallings, Operating Systems: Internals and Design Principles, 5th Edition, Prentice Hall of India, 2016.
3. Andrew S. Tanenbaum (2007), Modern Operating Systems, 2nd edition, Prentice Hall of India, India.

REFERENCE BOOKS

1. Maurice Bach, Design of the Unix Operating Systems, 8th Edition, Prentice-Hall of India, 2009.
2. Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, 3rd Edition, O'Reilly and Associates.

Course Code	Course Title						Core / Elective
3PC406CS	COMPUTER NETWORKS						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To provide a conceptual foundation for the study of data communications using the open Systems interconnect (OSI) model for layered architecture.
2. To study the principles of network protocols and internetworking
3. To understand the Network security and Internet applications.
4. To understand the performance of data link layer protocols for error and flow control.
5. To understand various routing protocols and network security.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand and explain the concept of Data Communication and networks, layered architecture and their applications
2. Evaluate data communication link considering elementary concepts of data link layer protocols for error detection and correction
3. Interpret the network layer, routing protocols and analyse how to assign the IP addresses for the given network
4. Examine the Transport layer services and protocols.
5. Comprehend the functionality of application layer.

UNIT I

Introduction to Data communication: Representation of data communication, flow of networks, Network Types: LAN, WAN, MAN. Network Topologies: Bus, Star, Ring, Hybrid. Line configurations. Reference Models: OSI, TCP/IP, Transmission media

Techniques for Bandwidth utilization: Multiplexing –Frequency division, time division and wave division, Asynchronous and synchronous transmission

UNIT II

Data Link Layer: Framing, Error Detection and Correction: Fundamentals, Block coding, Hamming Distance, CRC

Flow Control and Error Control Protocols: Stop and Wait, go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, HDLC

Multiple Access Protocols:ALOHA, CSMA, CSMA/CD, CSMA/CA.

UNITIII

Network Layer: Switching Techniques (Circuit and Packet) concept, Network layer Services,Sub-netting concepts
Routing algorithms: Shortest Path Routing, Flooding, Hierarchical routing, Broadcast, Multicast, Distance Vector Routing, and Congestion Control Algorithms.

UNIT IV

Internet Networking: Tunnelling, Fragmentation, Congestion Control(Leaky Bucket and Token Bucket Algorithm), Internet control protocols: ARP, RARP and DHCP
The Network Layer in Internet: IPV4, IPV6, IP Addressing, NAT.

UNIT V

Transport Layer: Transport Services, Elements of Transport Layer, Connection management, TCP and UDP protocols, QoS improving techniques.
Application Layer: Domain Name System, SNMP, SMTP, HTTP, Bluetooth

TEXTBOOKS

1. Andrew S Tanenbaum, "Computer Networks," 5/e, Pearson Education, 2011.
2. Behrouz A. Forouzan, "Data Communication and Networking,"4/e, TMH, 2008.
3. William Stallings, "Data and Computer Communications," 8/e, PHI, 2004.

REFERENCE BOOKS

1. Douglas EComer, "Computer Networks and Internet", Pearson Education Asia, 2000.
2. PrakashC. Gupta, "Data Communications and Computer Networks", PHI learning, 2013

Course Code	Course Title						Core / Elective
3HS403HS	HUMAN VALUES PROFESSIONAL ETHICS						HS
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	2	-	-	-	40	60	2

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To create an awareness on Human Values and Engineering Ethics.
2. To move from discrimination to commitment.
3. To understand social responsibility of an engineer.
4. To appreciate ethical dilemma while discharging duties in professional life.
5. To encourage students to discover what they consider valuable in life

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand the significance of value inputs in a classroom and start applying them in their life and profession
2. Assess their own ethical values and the social context of problems
3. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
4. Understand the role of a human being in ensuring harmony in society and nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

Unit-I: Introduction to Value Education (6 Hrs)

1. Value Education, Definition, Concept and Need for Value Education
2. The Content and Process of Value Education
3. Self-Exploration as a means of Value Education
4. Happiness -Sukh, Suvidha, Sanyam&Swasthya.

Unit-II: Harmony in the Human Being (6 Hrs)

1. Human Being is more than just the Body
2. Harmony of the Self ('I') with the Body
3. Understanding Myself as Co-existence of the Self and the Body
4. Understanding Needs of the Self and the Needs of the Body

Unit-III: Harmony in the Family and Society and Harmony in Nature (7 Hrs)

1. Family as a basic unit of Human Interaction and Values in Relationships
2. The Dynamics of Mutual respect in Today's World – Affection, Care, Guidance, Reverence, Gratitude and Love.
3. Comprehensive Human Goals: The Five dimensions of Human Endeavour – Justice, Trust,

Competence, Right Attitude and Mutual Tolerance

Unit-IV: Social Ethics (6 Hrs)

1. The Basics for Ethical Human conduct
2. Challenges to ethical conduct in existence
3. Holistic perception of Harmony in existence
4. Social Hierarchy - Ethical Conduct and Mutual Co-existence

Unit-V: Professional Ethics (6 Hrs)

1. Sanctity of Human values
2. Definitiveness of Ethical Human Conduct
3. Basics for Humanistic Education

TEXT BOOKS

1. A.N Tripathy, "Human Values", New Age International Publishers, 2003.
2. Bajpai. B. L., Indian Ethos and Modern Management, New Royal Book Co., Lucknow, Reprinted, 2004
3. Bertrand Russell Human Society in Ethics & Politics, Taylor and Francis, 2007

REFERENCE BOOKS

1. Corliss Lamont, Philosophy of Humanism,Humanist Press**,** 1997
2. Gaur. R.R. , Sangal. R, Bagaria. G.P, A Foundation Course in Value Education, Excel Books, 2009.
3. Gaur. R.R.,Sangal. R,Bagaria. G.P, Teachers Manual Excel Books, 2009.
4. Mortimer. J. Adler, – Whatman has made of man,Hardcover,2007.

Course Code	Course Title						Core / Elective
3PC455 CS	OPERATING SYSTEMS LAB						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student

1.To Learn various system calls in Linux

2.ToLearn different types of CPU scheduling algorithms.

3.ToDemonstrate the usage of semaphores for solving synchronization problem

4.ToUnderstand memory management techniques and different types of fragmentation.

5.To Learn various disk scheduling algorithms

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Use different system calls for writing application programs
2. Evaluate the performance of different types of CPU scheduling algorithms.
3. Implement producer-consumer problem, reader-writers problem, Dining philosopher's problem.
4. Simulate Banker's algorithm for deadlock avoidance.
5. Implement paging replacement and disk scheduling techniques

List of Programs(preferred programming language is C)

Perform a case study by installing and exploring various types of operating systems on a physical or logical (virtual) machine

1. Write C programs to implement UNIX system calls and file management system calls.
2. Write C programs to demonstrate various process related concepts.
3. Write C programs to demonstrate various thread related concepts.
4. Write C programs to simulate CPU scheduling algorithms: FCFS, SJF, Round Robin
5. Write C programs to simulate Intra & Inter-Process Communication (IPC) techniques: Pipes, Messages Queues, Shared Memory.
6. Write C programs to simulate solutions to Classical Process Synchronization Problems: Dining Philosophers, Producer-Consumer, Readers-Writers
7. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.
8. Write C programs to simulate Page Replacement Algorithms: FIFO, LRU
9. Write C programs to simulate implementation of Disk Scheduling Algorithms: FCFS, SSTF.
10. Shell programming: creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, and commands).

Course Code	Course Title						Core / Elective
3PC456CS	COMPUTER NETWORKS LAB						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. Learn to communicate between two desktops
2. Learn to implement different protocols
3. Be familiar with socket programming
4. Be familiar with various routing algorithms
5. Be familiar with different simulation tools

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Demonstrate a broad knowledge of the area of computer networking and its terminology
2. Understand to configure intermediary network devices
3. Program using sockets
4. Use simulation tools to analyze the performance of various network protocols
5. Implement and analyze various routing algorithms.

List of Programs

1. Running and using services/commands like tcpdump, netstat, ifconfig, nslookup, FTP, TELNET and trace route. Capture ping and trace route PDUs using network protocol analyzer and examine
2. Implement the data link layer framing methods such as character-stuffing and bit stuffing
3. Implement on a dataset of characters using CRC polynomialsCRC 12 and CRC 16
4. Initial Configuration of router and switch (using real devices or simulators)
5. Design and implement the following experiments using packet tracer software
   I. Simulation of network topologies
   II. Configuration of network using different routing protocols

6.Do the following using NS2/NS3/NetSim or any other equivalent tool

   I. Simulation of Congestion Control Algorithms
   II. Simulation of Routing Algorithms

7. Socket programming using UDP and TCP (e.g simple DNS, date & time client/server, echo client/server, iterative & concurrent servers)

8.Programming using RPC

Course Code	Course Title						Core / Elective
3PC457 CS	JAVA PROGRAMMING LAB						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	4	40	60	2

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To implement various java concepts.
2. To write java programs to solve mathematics, science and engineering problems.
3. To identify compile time and runtime errors, syntax and logical errors
4. To import the essentials of java class library and user defined packages.
5. To develop skills in internet programming using applets and swings.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. To understand the use of OOPs concepts.
2. Develop Java program using packages, inheritance and interface.
3. Develop java programs to implement error handling techniques using exception handling.
4. Develop graphical user interface using AWT.
5. Demonstrate event handling mechanism.

List of Programs

1. Implement the concept of classes and objects.
2. Implement Arrays to a given application.
3. Use String and String Tokenizer classes and develop a java programs.
4. Develop a java programs Using interfaces and packages.
5. Develop Java Programs using inheritance.
6. Develop Java programs using Method overloading and method overriding.
7. Develop java programs using Exception handling (using try, catch, throw, throws and finally).
8. Develop java programs using Multithreading (using Thread class and Runnable interface, synchronization).
9. Develop java programs using collections (using list, set, Map and generics).
10. CASE STUDY: Develop a program to calculate SGPA & CGPA of a student and display the progress report.
    INPUT:

INPUT		
ROLL NO	NAME	HOW MANY SEMESTERS? Semester wise : Subject Code, Subject Name And Marks

OUTPUT:
Progress report of <NAME>
Roll No:
Program(BE/ME)
Branch:
College Code and Name:
Year of joining:

Semester-I Grades	**Semester-II Grades**	**Semester-III Grades**
Subject 1:	Subject 1:	Subject 1:
Subject 2:	Subject 2:	Subject 2:
Subject 3:	Subject 3:	Subject 3:
….	….	….
SGPA :	SGPA :	SGPA :
CGPA :	CGPA :	CGPA :

Note: The above experiments can be implemented using any IDE.

SKILL DEVELOPMENT COURSE-II

Semester IV	**L**	**T**	**P**	**Credits**
Subject code – 3PW458CS	**0**	**0**	**2**	**1**

Guidelines for Evaluation of Skill Development

1. Continuous Evaluation method is adopted for skill development courses of all semesters and 40 marks are allocated for CIE.At the end of each module, the student is evaluated by allocating marks as given under.

   Observation : 10 marks
   Continuous Performance and Execution : 20 marks
   Viva-Voce : 10marks
   Average of marks obtained in all experiments is considered as the marksobtained in CIE

2. The Semester End Examination shall be conducted with an external examinerand the internal examiner for 60 marks. The external examiner shall be appointed bythe Principal from the panel of examiners recommended by Controller of Evaluation andBoard of Studies.

   Quiz/ Skill Test/Assignment/ Mini Project : 40 marks
   Viva-voce : 20 marks

Course Code	Course Title						Core / Elective
3PW458CS	CISCO CCNA MODULE I						PW
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. Explain the advances in modern network technologies, configure IP address, passwords etc
2. Explain how network protocols enable devices to access local and remote network resources
3. Explain how routers use network layer protocols and services to enable end-to-end connectivity
4. Implement IPv4 and IPv6 addressing scheme
5. Configure a switch port to be assigned to a VLAN based on requirements.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Build simple LANs, perform basic configurations for routers and switches,
2. Implement IPv4 and IPv6 addressing schemes.
3. Implement VLANs and trunking in a switched network
4. Implement DHCPv4 to operate across multiple LANs and explain how WLANs enable network connectivity.
5. Develop critical thinking and problem-solving skills using real equipment and Cisco Packet Tracer

MODULE I:

Networking today: Network Affect our Lives, Network Components, Network topologies, Types of Networks ,Basic Switch and End Device Configuration: IOS Access, Command Structure, basic device configuration, Ports and addresses, configuring IP address, protocols and models

MODULE II:

Physical Layer: Introduction to cables, Number Systems, Data Link Layer: Topologies, Data Link frame, Ethernet Switching :Ethernet Frame, MAC Address Table

MODULE III:

Network layer : IPv4 and IPv6 packet , addressing of IPv4 and IPv6
Address Resolution: MAC & IP, ARP, IPv6 Neighbour Discovery

MODULE IV:

ICMP, Transport layer : TCP & UDP ,Application Layer: Web and email protocols, IP Addressing Services

MODULE V:

Network Security Fundamentals: Network Attacks, Device Security

REFERENCES

CCNA ROUTING & SWITCHING BY CISCO PRESS

B. E. - Computer Science and Engineering

CSE Semester - V									
S. No.	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			L	**T**	**P / D**	**Contact Hours / week**	**CIE**	**SEE**	
Theory Courses									
1	3PC507CS	Artificial Intelligence	3	1	0	4	40	60	4
2	3ES501CS	Digital Image Processing	3	0	0	3	40	60	3
3	3PC508CS	Software Engineering	3	0	0	3	40	60	3
4	3PE5(01 TO 05)CS	Professional Elective – I	3	0	0	3	40	60	3
5	OE	Open Elective – I	3	0	0	3	40	60	3
6	3MC503HS	Indian Constitution	3	0	0	3	40	60	0
Practical / Laboratory Courses									
7	3PC559CS	Artificial Intelligence Lab	0	0	2	2	40	60	1
8	3ES551EC	Digital Image ProcessingLab	0	0	2	2	40	60	1
9	3PW560CS	Skill Development Course–III	0	0	2	2	40	60	1
10	3HS553HS	Soft Skills Lab - I	0	0	2	2	40	60	1
		Total Credits				**27**	**400**	**600**	**20**

Professional Elective – I

1	3PE501CS	Information Security
2	3PE502CS	Information Retrieval Systems
3	3PE503CS	Agile Methodologies
4	3PE504CS	Principles of Programming Languages
5	3PE505CS	DevOps

Open Elective - I

XOE501XX	**Open Elective - I**	**Offered by**
**1OE501AD	Artificial Intelligence	AI&DS
2OE501CE	Disaster Mitigation	CIVIL
**3OE501CS	Oops using JAVA	CSE
4OE501EE	Renewable Energy Systems	EEE
5OE501EC	Basics of Electronic Communication	ECE
6OE501ME	Start-up Entrepreneurship	MECH

****NOT APPLICABLE FOR CSE, AI&DS, AIML DEPARTMENTS**

Course Code	Course Title						Core / Elective
3PC507CS	ARTIFICIAL INTELLIGENCE						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	-	-	40	60	4

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. UnderstandtheimportanceofthefieldofAIbydiscussingitshistoryandvarious
2. LearnaboutoneofthebasicapplicationsofA.I,searchstateformulations
3. Learnmethodsofexpressingknowledgebyamachinewithappropriatereasoninganddifferent mathematicsinvolvedbehindit.
4. Learnhowtoreasonwhenanagenthasonlyuncertaininformationaboutitstask.
5. Know various supervised and unsupervised learning algorithms

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. FormalizeaprobleminthelanguageframeworkofdifferentAImethods.
2. IllustratebasicprinciplesofAIinsolutionsthatrequireproblemsolving,search,Inference
3. RepresentnaturallanguageEnglishusingPredicateLogictobuildknowledgethrough variousrepresentationmechanisms.
4. Demonstrateunderstandingofstepsinvolvedinbuildingofintelligentagents,expert systems,Bayesiannetworks
5. Differentiatebetweenlearningparadigmstobeappliedforanapplication

UNITI

ProblemSolving&Search:Introduction-
introductiontointelligenceFoundationsofartificialintelligence(AI). History of AI, Structure ofAgents.
ProblemSolving-
Formulatingproblems,problemtypes,statesandoperators,statespace.**SearchStrategies. -** Informed Search Strategies- Best first search, A* algorithm, heuristic functions,Iterativedeepening A*.
AdversarialSearch/Gameplaying-
Perfectdecisiongame,imperfectdecisiongame,evaluationfunction, alpha-beta pruning

UNIT II

Knowledge,Reasoning & Planning: Reasoning-
Knowledgebasedagent,PropositionalLogic,Inference, Predicate logic (firstorder logic),Resolution
StructuredKnowledge Representation– Frames, SemanticNets

Planning - A Simple Planning Agent, Form Problem Solving to Planning, Basicrepresentationof plans,partial order planning, hierarchicalplanning

UNIT III

Expert Systems, Reasoning with Uncertainty: Expert System and Applications: Introduction,Phases in Building Expert Systems, Expert System Architecture, Applications. **Uncertainty -** Basicprobability, Bayes rule, Belief networks, Inference in Bayesian Networks**,** Fuzzy sets, and fuzzylogic:Fuzzylogic system architecture, membership function. **DecisionMaking-**Utilitytheory,utilityfunctions

UNIT IV

Learning: Machine-Learning Paradigms: Introduction, Machine Learning Systems,Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees**Artificial Neural Networks:** Introduction, Artificial Neural Networks, Single-Layer Feed-ForwardNetworks, Multi-Layer Feed-ForwardNetworks
Reinforcementlearning: Learningfromrewards,PassiveandActivereinforcementlearning,Application s.

UNIT V

Communicating&Perceiving:IntroductiontoNLP-
Progress&applicationsofNLP,ComponentsofNLP, Grammars, Parsing.
AutomaticSpeechRecognition(ASR) –SpeechProcessing, Ex:DRAGON,HARPY,
Machine Vision – Applications, Basic Principles of Vision, Machine vision techniques: Low, Middleand High-level vision.
AIToday& Tomorrow- Achievements,ubiquitous AI.

TEXT BOOKS

1. Artificial Intelligence – A Modern Approach, Stuart Russell and Peter Norvig., III Edition, Pearson Education Press, 2009.
2. Artificial Intelligence, Kevin Knight, Elaine Rich, B. Nair, III Edition, McGraw Hill, 2008.

REFERENCE BOOKS

1. TheQuest forArtificial Intelligence,Nils J.Nilsson, Cambridge UniversityPress, 2009
2. Artificial Intelligence, Patrick Henny Winston, III Edition., Pearson Education, 1992.
3. Introduction to Artificial Intelligence and Expert Systems, Dan W Patterson, Pearson, 2015.

Course Code	Course Title						Core / Elective
3ES501CS	DIGITAL IMAGE PROCESSING						ES
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. To provide an approach towards image processing and introduction about 2D transforms
2. To expertise about enhancement methods in time and frequency domain
3. To expertise about segmentation and compression techniques
4. To understand the Morphological operations onan image
5. Understand different causes for image degradation and overview of image restoration techniques.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Explore the fundamental relations between
2. pixels and utility of 2-D transforms in image
3. processer.
4. Implement the various Morphological operations on an image
5. Describe different techniques employed for the enhancement of images.

UNIT I

Digital Image Fundamentals & Image Transforms: Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels.

Image Transforms: 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform.

UNIT II

Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighborhood criterion,MedianFilter, Spatial Domain High-Pass Filtering.

Image Enhancement (Frequency Domain): Filtering in Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

UNIT III

Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT IV

Image Segmentation: Detection of Discontinuities, Edge Linking And Boundary Detection, thresholding, Region Oriented Segmentation.
Morphological Image Processing: Dilation and Erosion: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss Transformation.

UNIT V

Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

TEXTBOOKS

1. Digital Image Processing - Rafael C. Gonzalez, Richard E. Woods, III Edition, Pearson, 2008
2. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar- TMH, 2010, II Edition
3. Fundamentals of Digital Image Processing: A. K. Jain, PHI.

REFERENCE BOOKS

1. Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools - ScotteUmbaugh, II Edition, CRC Press, 2011
2. Digital Image Processing using MATLAB – Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, II Edition, TMH, 2010.
3. Digital Image Processing and Computer Vision – Somka, Hlavac, Boyle- Cengage Learning (Indian edition) 2008.
4. Introductory Computer Vision Imaging Techniques and Solutions- Adrian low, II Edition, BS Publication, 2008.

Course Code	Course Title						Core / Elective
3PC508CS	SOFTWARE ENGINEERING						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To Describe and compare various software development methods and understand the context in which each approach might be applicable
2. To impart knowledge on various phases, methodologies and practices of software development
3. Toapplytheprojectmanagementandanalysisprinciplestosoftwareprojectdevelopment
4. To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metric
5. Toapplythedesign&testingprinciplestosoftwareprojectdevelopment.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Acquired working knowledge of alternative approaches and techniques for each phase of SDLC.
2. Judge an appropriate process model(s) for software project attributes and analyze requirements for project development.
3. Acquire skills necessary as an independent or as part of a team for architecting a complete software project by identifying solutions for recurring problems exerting
4. Concede product quality through testing techniques employing appropriate metrics by understanding the practical challenges associated with the development of a significant software system
5. Apply the software engineering principles in real time project development

UNIT I

Introduction to Software: Types of software**,** Characteristics of Software Attributes of good software.

Software Engineering: software engineering, Software engineering costs, key challenges facing software engineering, Systems engineering & software Engineering, SDLC.

SoftwareDevelopmentProcessModels:

PrescriptiveModels,WaterfallModel,IncrementalProcessModels,Evolutionary Process Models, Specialized Process Models, The UnifiedModels, PersonalandTeam Process Models, Process Technology,Product and Process.

UNIT II

SoftwareEngineeringPrinciples:SEPrinciples,CommunicationPrinciples,PlanningPrinciples,ModellingPrinciples, ConstructionPrinciples, Deployment.
SoftwareRequirementAnalysisandSpecification: Systemandsoftwarerequirements, Typesofsoftwarerequirements, Elicitationandanalysisofrequirements,Requirement validation, Requirementspecification, Feasibility

UNIT III

BuildingtheAnalysisModel: Data ModelingConcepts,Object-OrientedAnalysis,Scenario-basedModeling,Flow-orientedModeling,Class-basedModeling.
Design Engineering: Design Process and Quality,DesignConcepts, the Design Model,
Performing User Interface Design: The Golden Rules, User Interface Analysis and Design,InterfaceAnalysis,InterfaceDesignSteps, DesignEvaluation.

UNIT IV

CreatinganArchitecturalDesign: SoftwareArchitecture,DataDesign,ArchitecturalStylesandPatterns, Architectural Design.
Coding: Programminglanguagesanddevelopmenttools, Selectinglanguages andtools Goodprogrammingpractices, Coding Standards

UNIT V

SoftwareTestingandQualityAssurance: Verification and validation Techniques of testing Black-box and White-box testing Inspections Levels of testing Unit testing, Integration Testing, Interface testing, System testing, Alpha and beta testing, Regression testing Design of test cases, Quality management activities: Product and process quality Standards, ISO900, Capability Maturity Model (CMM), Risk management
Debugging: DebuggingTechniques,TheArtofDebugging.
CurrenttrendsinSoftwareEngineering Software Engineering for projects and products

TEXTBOOKS

1. Software Engineering: A Practitioner's Approach, Roger S. Pressman, VII Edition,McGraw Hill, 2009
2. SoftwareEngineering.IanSommerville,VIIedition,Addison-Wesley, 2004.
3. FundamentalsofSoftwareEngineeringRajibMall, V Edition, PHI, 2009.

REFERENCE BOOKS

1. Software Engineering Fundamentals, Ali Behforooz and Frederick J. Hudson, OxfordUniversity Press, 1996
2. An Integrated Approach to Software Engineering, PankajJalote, III Edition, NarosaPublishing House, 2000
3. Software Engineering, an Engineering approach- James F. Peters, WitoldPedrycz,VIII Edition, John Wiley.

Course Code	Course Title						Core / Elective
3PE501CS	INFORMATION SECURITY						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. Explain the importance and application of each of confidentiality, integrity, Authentication and availability.
2. Understand the various cryptographic algorithms.
3. Understand the basic categories of threats to computers and networks
4. Describe the enhancements made to IPv4 by IPSec.
5. Discuss Web security and Firewalls

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand basic cryptographic algorithms, message and web authentication and security issues.
2. Identify information system requirements for both of them such as client and server
3. Understand the current legal issues towards information
4. Distinguish and explain different protocol like SSL, TLS and their applications
5. Comprehend and explain security services and mechanisms

UNIT I

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security. Classical Encryption Techniques, DES, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operation, Blowfish, Placement of Encryption Function, Traffic Confidentiality, key Distribution, Random Number Generation.

UNIT II

Public key Cryptography Principles, RSA algorithm, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography. Message authentication and Hash Functions, Authentication Requirements and Functions, Message Authentication, Hash Functions and MACs Hash and MAC Algorithms SHA-512, HMAC.

UNIT III

Digital Signatures, Authentication Protocols, Digital signature Standard, Authentication Applications, Kerberos, X.509 Directory Authentication Service. Email Security: Pretty Good Privacy (PGP) and S/MIME.

UNIT IV

IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management. Web Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

UNIT V

Intruders, Viruses and Worms Intruders, Viruses and related threats Firewalls: Firewall Design Principles, Trusted Systems, Intrusion Detection Systems.

TEXTBOOKS

1. Cryptography and Network Security - Principles and Practice: William Stallings, VII Edition, Pearson Education, 2017.
2. Cryptography and Network Security: AtulKahate, Mc Graw Hill, 3rd Edition, 2017.

REFERENCE BOOKS

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, I Edition, 2011.
2. Cryptography and Network Security: ForouzanMukhopadhyay, Mc Graw Hill, III Edition, 2015.
3. Information Security, Principles, and Practice: Mark Stamp, 2nd Edition, Wiley India, 2011.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, IV Edition, McGraw-Hill Education, 2016.

Course Code	Course Title						Core / Elective
3PE502CS	INFORMATION RETRIEVAL SYSTEMS						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. To learn the different models for information storage and retrieval
2. To learn about the various retrieval utilities
3. To understand indexing and querying in information retrieval systems
4. To expose the students to the notions of structured and semi structured data
5. To learn about web search

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understands to store and retrieve textual documents using appropriate models
2. Uses the various retrieval utilities for improving search
3. Understands the indexing and compressing documents to improve space and time efficiency
4. Formulates SQL like queries for unstructured data
5. Understands issues in web search

UNIT I

Introduction, Retrieval Strategies: Vector space model, Probabilistic retrieval strategies: Simple term weights, Non binary independence model, Language Models.

UNIT II

Retrieval Utilities: Relevance feedback, Clustering, N-grams, Regression analysis, Thesauri.

UNIT III

Retrieval Utilities: Semantic networks, Parsing

Cross-Language Information Retrieval: Introduction, Crossing the language barrier.

UNIT IV

Efficiency: Inverted index, Query processing, Signature files, Duplicate document detection.

UNIT V

Integrating Structured Data and Text: A Historical progression, Information retrieval as a relational application, Semi-structured search using a relational schema

Distributed Information Retrieval: A Theoretical model of distributed retrieval, Web search.

TEXTBOOKS

1. Information Retrieval – Algorithms and Heuristics, Springer, David A. Grossman, Ophir Frieder, II Edition (Distributed by Universities Press)
2. Information Storage and Retrieval Systems, Gerald J Kowalski, Mark T Maybury,II Edition, Springer, 2000

REFERENCE BOOKS

1. Mining the Web: Discovering Knowledge from Hypertext Data, SoumenChakrabarti, Morgan-Kaufmann Publishers, 2002
2. An Introduction to Information Retrieval, Christopher D. Manning, PrabhakarRaghavan, HinrichSchütze, Cambridge University Press, Cambridge, England, 2009
3. Modern Information Retrieval by Yates and Neto, IV Edition, Pearson Education.

Course Code	Course Title						Core / Elective
3PE503CS	AGILE METHODOLOGIES						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To introduce good practices for requirements engineering
2. To understand requirements elicitation and elicitation techniques
3. To learn the usage of analysis models and software quality attributes
4. To acquire knowledge on software estimation, size estimation, effort, schedule and cost estimation
5. To understand software estimation tools such as COCOMO, IFPUG, SLIM

COURSE OUTCOMES: After the completion of course the students will be able to:

1. Gain knowledge about software requirements, requirements management, their principles and practices
2. Analyze requirement elicitation techniques and prototyping
3. Analyze use-case modelling and different data diagrams
4. Estimate software in terms of size, cost, effort and schedule
5. Use software estimation tools such as COCOMO, IFPUG, SLIM

UNIT I

SoftwareRequirements:WhatandWhy: Essential Software requirement, Good practices for requirements engineering, Improving requirements processes,Software requirements and risk management.

SoftwareRequirementsEngineering: Requirementselicitation,requirementsanalysisdocumentation,review,elicitationtechniques,analysismodels,Softwarequalityattributes,riskreductionthroughprototyping,settingrequirementspriorities,verifyingrequirementsquality.

UNIT II

SoftwareRequirementsManagement: RequirementsmanagementPrinciples and practices, Requirements attributes, Change Management Process, Requirements Traceability Matrix, Links in requirements chain

SoftwareRequirementsModeling: UseCaseModeling,AnalysisModels,Dataflowdiagram,statetransitiondiagram,classdiagrams,Objectanalysis,ProblemFrames

UNIT III

Software Estimation: Components of Software Estimations, Estimationmethods, Problems associated with estimation, Key project factors thatinfluenceestimation.
Size Estimation: Two views of sizing, Function Point Analysis, Mark IIFPA, Full Function Points, LOC Estimation, Conversion between sizemeasures.

UNIT IV

Effort,ScheduleandCostEstimation: WhatisProductivity?EstimationFactors,ApproachestoEffortandScheduleEstimation,COCOMOII,PutnamEstimationModel,Algorithmicmodels,CostEstimation

UNIT V

ToolsforRequirementsManagementandEstimation

Requirements Management Tools: Benefits of using a requirementsmanagement tool, commercial requirements management tool, RationalRequisite pro, Caliber – RM, implementing requirements managementautomation.
Software Estimation Tools: Desirable features in software estimationtools,IFPUG,USC'sCOCOMOII,SLIM(SoftwareLifeCycleManagement) Tools.

TEXTBOOKS

1. Software RequirementsandEstimation,SwapnaKishore,Rajesh Naik, I Edition,TataMc GrawHill,2001
2. SoftwareRequirements, KarlE.Weigers,II Edition,Microsoft Press,2003

REFERENCE BOOKS

1. Managing Software Requirements, Dean Leffingwell& Don Widrig, Pearson Education, 2003.
2. Mastering the requirements process, II Edition, Suzanne Robertson & James Robertson, Pearson Education, 2006.
3. Estimating Software Costs, II Edition, Capers Jones, TMH, 2007.
4. Practical Software Estimation, M.A. Parthasarathy, Pearson Education, 2007

Course Code	Course Title						Core / Elective
3PE504CS	PRINCIPLES OF PROGRAMMING LANGUAGES						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. To understand the fundamental concepts of principles of language design, formal syntax and semantic, BNF.
2. To understand different data types, variables, expressions, types of statements, different types of control statements and iterations.
3. To understand the concept of Sub programs and blocks, operator overloading, and co-routines.
4. To understand the concept of Abstract data types, concurrency, exception handling of different programming languages and logic programming languages
5. To understand Functional Programming Languages like FPL, LISP, ML languages.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Ability to express syntax and semantics in formal notation.
2. Ability to apply suitable programming paradigm for the application.
3. Gain Knowledge and comparison of the features programming languages
4. Program in different language paradigms and evaluate their relative benefits.
5. Identify and describe semantic issues associated with variable binding, scoping rules, parameter passing, and exception handling.

UNIT I

Preliminary Concepts: Reasons for studying, concepts of programming languages, Programming domains, Language Evaluation Criteria, influences on Language design, Language categories, ProgrammingParadigms – Imperative, Object Oriented, functional Programming, Logic Programming. Programming Language Implementation – Compilation and Virtual Machines, programming environments. Syntax and Semantics: general Problem of describing Syntax and Semantics, formal methods of describing syntax - BNF, EBNF for common programming languages features, parse trees, ambiguous grammars, attribute grammars, denotation semantics and axiomatic semantics for common programming languagefeatures.

UNIT II

Data types: Introduction, primitive, character, user defined, array, associative, record, union, pointer and reference types, design and implementation uses related to these types. Names, Variable, concept

of binding, type checking, type compatibility, named constants, variable initialization. Expressions and Statements: Arithmetic relational and Boolean expressions, Short circuit evaluation mixed mode assignment, Assignment Statements, Control Structures – Statement Level, Compound Statements, Selection, Iteration, Unconditional Statements, guarded commands

UNIT III

Software Estimation: Components of Software Estimations, Estimationmethods, Problems

Subprograms Blocks and Fundamentals of sub-programs: Scope and lifetime of variable, static and dynamic scope, Design issues of subprograms, local referencing environments, parameter passing methods, overloaded sub-programs, generic sub-programs, parameters that are subprogram names, design issues for functions user defined overloaded operators, co routines.

UNIT IV

Abstract Data Types: Abstractions and Encapsulation, Introduction to Data Abstraction, Design Issues, Object Oriented Programming in C++, Java,Ada 95.
Exception Handling: Exceptions, Exception Propagation, Exception Handler in Ada, C++ and Java.
Logic Programming Language: Introduction and Overview of Logic Programming, Basic Elements of Prolog, Application of Logic Programming.

UNIT V

Functional Programming Languages: Introduction, fundamentals of FPL, LISP, ML application of Functional Programming Languages and comparison of functional and imperative Languages. Key Concepts, Case Study: Python – Values and Types, Variables, Storage and Control, Bindings and Scope, Procedural Abstraction, Data Abstraction, Separate Compilation, Module Library.

TEXTBOOKS

1. Concepts of Programming Languages Robert.W. Sebesta 8/e, Pearson Education, 2008.
2. Programming Languages Design Concepts, D. A. Watt, Wiley Dreamtech, rp – 2007

REFERENCE BOOKS

1. Programming languages, 2nd Edition A. B. Tucker, R E Noonan, TMH
2. Programming Languages, K C Louden, 2nd Edition, Thomson, 2003.
3. LISP Patric Henry Winston and Paul Horn Pearson Education.
4. Programming in PROLOG W F Clocksin& C S Mellish, V Edition, Springer

Course Code	Course Title						Core / Elective
3PE505CS	DevOps						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. Describe the agile relationship between development and IT operations
2. Understand the skill sets and high-functioning teams involved in DevOps and related methods
3. Implement automated system update and DevOps lifecycle.
4. Understand concepts of Devops maturity and assessment.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Identify components of Devops environment.
2. Describe Software development models and architectures of DevOps.
3. Apply different project management, integration, testing and code deployment tool.
4. Investigate different DevOps Software development models.
5. Assess various Devops practices

UNIT I

Introduction: Introduction, Agile development model, DevOps, and ITIL. DevOps process andContinuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples.

UNIT II

Software development models and DevOps: DevOps Lifecycle for Business Agility, DevOps, andContinuous Testing. **DevOps influence on Architecture:** Introducing software architecture, Themonolithic scenario, Architecture rules of thumb, The separation of concerns, Handling databasemigrations, Micro services, and the data tier, DevOps, architecture, and resilience.

UNIT III

Introduction to project management: The need for source code control, The history of source codemanagement, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit,The pull request model, GitLab.

UNIT IV

Integrating the system: Build systems, Jenkins build server, Managing build dependencies, Jenkinsplugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Jobchaining and build pipelines, Build servers and infrastructure as code, Building by dependency order,Build phases, Alternative build servers, Collating quality measures.

UNIT V

Testing Tools and automation: Various types of testing, Automation of testing Pros and cons,Selenium - Introduction, Selenium features, JavaScript testing, testing backend integration points,Test-driven development, REPL-driven development

Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client,Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker

TEXTBOOKS

1. Practical Devops, Joakim Verona. II Edition, Packt Publishing, 2018.
2. DevOps Tools from Practitioner's Viewpoint, Deepak Gaikwad, Viral Thakkar, Wiley publications, 2020.

REFERENCE BOOKS

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. AddisonWesley; ISBN-10.
2. Effective DevOps, Jennifer Davis &Ryn Daniels, IV Edition, O'Reilly
3. The DevOps Handbook, Gene Kim, Jez Humble, Patrick Debois, John Willis, First Edition, IT Revoultion Press, LLC

Course Code	Course Title						Core / Elective
1OE501AD	ARTIFICIAL INTELLIGENCE						OE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

1. TointroducetheAItechniquestosolveproblems and search strategies to findoptimal solution paths from start to goalstate.
2. To introduces different knowledgerepresentationmethodsinAIPrograms.
3. TointroducedifferentdesigntechniquesforGame PlayingPrograms.
4. TointroducetheAIAgentstheirdesign,planning andlearningtechniques.
5. To introduce the natural language processing and expert systems.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand fundamental AI concepts andidentifyarangeofsymbolicandnon-symbolicAItechniques.
2. Demonstrate an understanding of varioussearching algorithms such as adversarialsearchandgame-playingcommonlyusedinartificialintelligence software.
3. Usedifferentknowledgerepresentationtechniquesusedin AIApplications.
4. Demonstrate an understanding of agentbasedAIarchitectures,Planningandlogicbasedagents.
5. ExploringExpertsystems options.

UNITI

Introduction: Artificial Intelligence and its applications, Artificial Intelligence Techniques**Problem solving techniques:** State space search, control strategies, heuristic search, problemcharacteristics,productionsystemcharacteristics.,Generateandtest,Hillclimbing,bestfirst search,A*search,AO*search,Constraintsatisfactionproblem,AgendaDrivenSearch,Mean-end analysis,Min-MaxSearch,Alpha-BetaPruning,IterativeDeepening.

UNITII

Knowledgerepresentation: Mappingbetweenfactsandrepresentations,Approachestoknowledgerepresentation,proceduralvsdeclarativeknowledge,Forwardvs.Backwardreasoning,Matching,conflictresolution,Weakand Strongfillerstructures.

UNITIII

NonMonotonicandStatisticalReasoning:onmonotonicLogic,DefaultLogic,Circumscription, Bayes Theorem, Bayesian Network, Dempster Shafer Theory, Fuzzy sets,FuzzyLogic,Defuzzification.

UNITIV

PlanningandLearningAgents: IntelligentAgents,NatureandstructureofAgents,LearningAgents,IntroductiontodifferentFormsofLearning,ThePlanningproblem,planning with state space search,partial order planning,planning graphs,planning withpropositionallogic,Analysisofplanningapproaches,Hierarchicalplanning,conditionalplanning,Continuous andMultiAgentplanning.

UNITV

Introduction to Learning and Expert system: Expert systems, Expert system examples,Expert System Architectures, Rule base Expert systems, Non Monotonic Expert Systems,DecisiontreebaseExpertSystems.

TEXTBOOKS

1. AI:AModernApproachStuartJ.Russel,PeterNorvigPearsonEducationLatestEdition,2012
2. ArtificialIntelligenceElaineRich,Knight McGrawHillThirdEdition, 2010
3. ArtificialIntelligence,SarojKaushikCengageLearning,FirstEdition, 2011

REFERENCES

1. ArtificialIntelligence,PartickHenryWinstonAddisonWesleyLatestEdition, 2012
2. ArtificialIntelligenceGeorgeLugerPearsonEducationLatestEdition, 2010

Course Code	Course Title						Core / Elective
2OE501CE	DISASTER MITIGATION						OE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

Uponcompletionofthiscourse,studentswillbeableto:

1. Definedisasterandexplainthedifferenttypesofdisasters.
2. DescribethedisastermanagementcycleandtheroleofNDMA in disastermanagement.
3. Analyze the legal aspects of disastermanagement.
4. Developdisastermitigationplans.
5. Participateindisasterresponseandrecoveryactivities.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Demonstrate the concepts ofdisaster management
2. Identifydifferenttypes ofdisasters
3. Explainthedisastermanagementcycle
4. IllustratetheroleofNDMAindisastermanagement
5. 5. Explain the development of disaster mitigationplan

UNIT I

Introduction to Disaster Management: Definition of disaster, Types of disasters, History ofdisaster management in India, National Disaster Management Authority (NDMA) and its role indisastermanagement,Disastermanagementcycle.CasestudiesofdisastersinIndiaandtheworld

UNITII

Disaster Mitigation: Mitigation measures for different types of disasters, Use of technology indisaster mitigation, Disaster risk assessment, Disaster preparedness, Exercises and simulations ondisastermitigation.

UNITIII

DisasterResponse: Searchandrescueoperations,Medicalrelief,Foodandshelter,Restorationofessen tialservices,Rehabilitationandreconstruction,

UNITIV

Disaster Law and Policy: Disaster management acts of India, Disaster management policies of India,Legalaspectsof disastermanagement

UNITV

Disaster Communication and Public Awareness: Importance of communication in disaster management,Methods of disaster communication, Public awareness programs, Case studies of disaster communicationandpublic awarenessinIndiaandthe world

TEXTBOOKS

1R.Subramanian,Disaster Management,VikasPublishingHouse,2018.

2. .M.M.Sulphey,DisasterManagement,PHILearning,2016.

REFERENCEBOOKS

1. S. C. Sharma, Disaster Management: Concepts, Approaches and Techniques, Khanna Book PublishingHouse,2017.

2.G.K.Ghosh,DisasterManagement:TheoryandPractice,APHPublishingCorporation,2018.

Course Code	Course Title						Core / Elective
3OE501CS	OOPS USING JAVA						OE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. The Java programming language: its syntax, idioms, patterns and styles.
2. Object oriented concepts in Java and apply for solving the problems.
3. How exception handling and multithreading makes Java robust.
4. Explore java Standard API library such as io, util, applet,awt.
5. Building of applications using Applets and Swings..

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understandthe concept of OOP and analyzerelationships among classes, objects.
2. Developprograms usingconcepts like inheritance, packages, interfaces, Java I/O streams and strings
3. Utilize exception handling and Multithreading concepts to develop Java programs
4. Interpretthe Java Collection API, Java utility classes, concept of files and serialization
5. Design GUI applications using concepts like AWT controls and Swings and client server programs using networking concepts

UNIT I

Object Oriented Programming: Principles, Benefits of Object Oriented Programming.
Introduction to Java: Java buzzwords, bytecode. Java Programming Fundamentals: Applet and Application program using simple java program, data types, variables, arrays, operators, expressions, control statements, type conversion and casting, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, introducing access control, static, final, nested and inner classes, exploring string class, using command-linear arguments.
Inheritance: Inheritance concept, types of inheritance, Member access rules, use of super and final.
Polymorphism - dynamic binding, method overriding, abstract classes and methods.

UNIT II

Interfaces: Defining an interface, implementing interfaces, extending interface.
Packages: Defining, Creating and Accessing a Package, importing packages
Exception handling: Benefits of exception handling, classification, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, rethrowing exceptions, built in exceptions, creating own exception sub classes

Multithreading: Java Thread Model, The Main Thread, creating a Thread, creating multiple threads, using is Alive() and join(), thread priorities, synchronization, inter thread communication, deadlock

UNIT III

Collections: Overview of Java Collection frame work, commonly used Collection classes – Array List, Linked List, Hash Set, Tree Set, Collection Interfaces – Collection, List, Set. Accessing Collection via iterator, working with Map. Legacy classes and interfaces – Vector, Hashtable, Stack, Dictionary, Enumeration interface.
Other Utility classes: String Tokenizer, Date, Calendar, Gregorian Calendar, Scanner Java Input/Output: exploring java.io, Java I/O classes and interfaces, File, Stream classes, byte stream, character stream, serialization.

UNIT IV

GUI Programming with java: The AWT class hierarchy, MVC architecture.
Applet Revisited: Basics, architecture and skeleton, simple applet program.
Event Handling: Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces.Handling mouse and keyboard events, Adapter classes.
Database Programming using JDBC: Introduction to JDBC, JDBC Drivers & Architecture, CURD operation Using JDBC, Connecting to non-conventional Databases.

UNIT V

Exploring Swing:JLabel, ImageIcon, JTextField, the Swing buttons, JTabbedpane, JScrollPane, JList, JComboBox.
Servlet: Life cycle, using tomcat, simple servlet, servlet API, javax.servlet package, reading servlet parameters, javax.servlet.http package, handling HTTP requests and responses

TEXTBOOKS

1. Java: The Complete Reference, X Edition, Herbert Schildt, McgrawHill, 2017.
2. Java Fundamentals: A Comprehensive Introduction, Herbert Schildt and Dale Skrien, McGraw Hill Education, 2017.
3Java How to Program, Early Objects (Deitel: How to Program), P.J.Dietel XI Edition, PearsonEducation, 2017.

REFERENCE BOOKS

1. TheJavaProgramming Language, Ken Arnold, David Holmes, James Gosling, Prakash Goteti, III Edition, Pearson 2008.
2. An Introduction to OOP, T. Budd, IIIEdition, Pearson Education, 2008.
3. Introduction to Java Programming, Y. Daniel Liang, X Edition, Pearson Education, 2018.

Course Code	Course Title						Core / Elective
4OE501EE	RENEWABLE ENRERGY SYSTEMS						OE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. TounderstandtheconceptsandImportanceofrenewableenergysourcessuch as solar,wind,biomass,tidalpower.
2. Tomakethestudentsunderstandtheadvantagesanddisadvantagesofdifferentrenewableenergysources

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Explain theadvantages,disadvantagesandapplicationsofdifferentconventionalandnon-conventionalsources.
2. Acquire the knowledge of various components, principle of operation and present scenario of different conventional and non-conventionalsources.

UNITI

Review of Conventional and Non-Conventional energy sources - Need for non-conventional energy sources Types of Non-conventional energy sources - Fuel Cells - Principle of operation with special reference to H2 °2Cell - Classification and Blockdiagramoffuelcellsystems-Ionexchange membrane cell-Moltencarbonatecells-Solidoxideelectrolytecells-Regenerative system- Regenerative Fuel Cell - Advantages and disadvantages of Fuel Cells — Polarization - ConversionefficiencyandApplicationsofFuelCells.

UNIT II

Solar energy - Solar radiation and its measurements - Solar Energy collectors -Solar Energy storage systems - Solar Pond -ApplicationofSolarPond-Applicationsofsolarenergy,V-IandP-Vcurves andtheconceptofMPPT

UNIT III

Wind energy- Principles of wind energy conversion systems- Nature of wind - Power in the Wind-Basic components ofWECS - Classification of WECS - Site selection considerations - Advantages and disadvantages of WECS - Wind energycollectors -

Windelectricgeneratingandcontrolsystems-ApplicationsofWindenergy-Environmentalaspects.

UNIT IV

Energy from the Oceans - Ocean Thermal Electric Conversion (OTEC) methods - Principles of tidal power generation -Advantages and limitations of tidal power generation -Ocean waves - Wave energy conversion devices -Advantages anddisadvantages of wave energy - Geo-thermal Energy - Types of Geo-thermal Energy Systems - Applications of Geo-thermalEnergy.

UNIT V

Energy from Biomass - Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogasgeneration - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants inIndia-Advantages anddisadvantages ofBiogas generation-Thermalgasificationofbiomass-Biomass gasifiers

TEXTBOOKS

1. RaiG.D,Non-ConventionalSourcesofEnergy,KhandalaPublishers,NewDelhi,2011.
2. DavidMBuchlaandThomasEKissell, RenewableEnergySystems,1stEdition by,PearsonIndia, 2017.

REFERENCE BOOKS

1. M.M.El-Wakil,PowerPlantTechnology,McGrawHill,1984.
2. John Twidell, Tony Weir, Renewable Energy R73esources, III Edition, Taylor and Francis, 2015.

CourseCode	CourseTitle						Core/Elective
5OE501EC	BASICSOFELECTRONICCOMMUNICATION						OE
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
BEE	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

1. Toprovideanintroductiontofundamentalconceptsintheunderstandingofcommunicationssystems.
2. Todescribethenetworkmodelandsomeofthenetworklayers includingphysicallayer,datalinklayer,networklayerandtransportlayer.
3. Todiscusstheevolutionofwirelesssystemsandcurrentwirelesstechnologies.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understandtheworkingofanalogganddigitalcommunicationsystems.
2. ExplaintheOSInetworkmodeland theworking ofdatatransmission.
3. describetheevolutionofcommunicationtechnologiesfromtraditionaltelephonysystemstomodernwireless communicationsystems.
4. Differentiatebetweenanalogganddigitalmodulationtechniques
5. Understandtheopticalfibrecommunicationlink,structure,propagationandtransmissionproperties.

UNITI

IntroductiontoCommunicationsystems: ElectromagneticFrequencySpectrum,Signalanditsrepresentation, ElementsofElectronicCommunicationsSystem,TypesofCommunicationChannels.

Signal Transmission Concepts: Baseband transmission and Broadband transmission, CommunicationParameters: Transmitted power, Channel bandwidth and Noise, Need for modulation **Signal Radiationand Propagation:** Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters andMechanismsofPropagation.

UNITII

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation anddemodulation,Digital converters,Digitalmodulationschemes–ASK,FSK,PSK,QPSK,Digitaldemodulation

UNITIII

Data Communication and Networking: Network Models, OSI Model, Data Link Layer–MediaAccess control, Ethernet, Network Layer – Internet Protocol (IPv4/IPv6), Transport Layer – TCP, UDP.

UNITIV

TelecommunicationSystems: Telephones,Telephonesystem,OpticalCommunications:OpticalPri nciples, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers,WavelengthDivisionMultiplexing.

UNIT V

Wireless Communications: Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, OFDM.Current Wireless Technologies: Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFIDcommunication,UWB,Wirelessmeshnetworks,Vehicularadhoc networks.

TEXTBOOKS

1. LouisE.Frenzel,"PrinciplesofElectronicCommunicationSystems",IIIedition,McGrawHill,2008.
2. GeorgeKennedy,BernardDavis,"ElectronicCommunicationsystems",IVedition,McGrawHill,1999
.

REFERENCEBOOKS

1. BehrouzA.Forouzan,"DataCommunicationsandNetworking",Vedition,TMH,2012.
2. RappaportT.S.,"Wirelesscommunications",IIedition,PearsonEducation,2010.
3. WayneTomasi,"AdvancedElectronicCommunicationsSystems",VIedition,PearsonEducation.

CourseCode	CourseTitle						Core/Elective
6OE501ME	START-UP ENTREPRENEURSHIP						OE
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

CourseObjectives:

Studentsshouldbeableto understand

1. Tomotivatestudents to takeupentrepreneurship infuture.
2. Tolearnnuancesof startinganenterprise&projectmanagement.
3. Tounderstand project formulationandchoiceTechnologyin Enterprise.
4. TounderstandIntellectualproperties,patents,Start-ups.

COURSEOUTCOMES:

After thecompletionof coursethestudentswillbeableto:

1. UnderstandEntrepreneurshipandEconomicgrowth,SmallandLargeScaleIndustries,Types andforms of enterprises.
2. Identify the characteristics of entrepreneurs, Emergence of first generationentrepreneurs,Conception and evaluation ofideasand theirsources.
3. Practicetheprinciplesofprojectformulation,Analysisofmarketdemand,Financialandprofitability analysis and Technical analysis.
4. Understandthe conceptof IntellectualPropertyRightsandPatents
5. ComprehendtheaspectsofStart-Ups.

UNIT 1

Entrepreneurship:Definition, functions of Entrepreneurship,Characteristics and qualities ofentrepreneurs, Entrepreneur vs. intrapreneur, need of innovation, Economic growth. SmallScale IndustryinIndia,Linkageamongsmall, medium and heavyindustries.

UNIT II

IndianIndustrialEnvironment:Competence, OpportunitiesandChallenges,Emergenceof First generationentrepreneurs, women entrepreneurs. Conception and evaluation of ideasandtheirsources.Typesofenterprises.CollaborativeinteractionforTechnologydevelopment.CorporateSocial Responsibility

UNITIII

Projectformulation:Introduction,ElementsofBusinessPlananditssalientfeatures,Analysisof market demand,Financialand profitabilityanalysis and Technicalanalysis.

UNIT IV

Intellectual Property Rights: Meaning, Nature, Classification and protection of

IntellectualProperty,themainformsofIntellectualProperty,ConceptofPatent,Patentdocument,Inventionprotection,Grantingofpatent,Rightsofapatent,Licensing,Transferoftechnology.

UNIT V

Aspects of Start-Up: What is Start-Up, Start-up Policy, start-up strategy, Progress of startupsin India, Principles of future organizations, start-up sectors and action plan for start-ups byGovt.ofIndia.

TEXTBOOKS

1. VasantDesai,"DynamicsofEntrepreneurialDevelopmentandManagement",HimalayaPublishingHouse,
2. PrasannaChandra,"Project-Planning,Analysis,Selection,ImplementationandReview",TataMcGraw-Hill PublishingCompanyLtd.
3. AjitParulekarandSaritaD'Souza,IndianPatentsLaw–Legal&BusinessImplications,MacmillanIndiaLtd.

REFERENCE BOOKS

1. StephenR.CoveyandA.RogerMerrill,"FirstThingsFirst",SimonandSchusterPublication.
2. G.S.Sudha,"OrganizationalBehaviour".
3. RobertD.Hisrich,MichaelP.Peters,"Entrepreneurship",TataMeGrawHillPublishingCompanyLtd., 5lhEd.
4. G.B.Reddy,IntellectualPropertyRightsandtheLaw5thEd.GogiaLawAgency.

Course Code	Course Title						Core / Elective
3MC503HS	INDIAN CONSTITUTION						MC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	-

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. To create awareness and relevance of the Indian Constitution, its directive principles.
2. To impart understanding of the role, powers and functions of administration at the Central, State and local levels.
3. To create awareness and understanding of Fundamental Rights, State Policy and Duties of Ideal citizen
4. To expose students to the relations between Central/Federal, State and Provincial units, divisions of executive, legislative and judiciary in them.
5. To impart knowledge about the statutory institutions and their role.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Have a general knowledge and back ground about the Constitution of India and its importance.
2. Will distinguish and understand the working of the Central, state and provincial levels of administration.
3. Will be conscious about the fundamental duties, responsibilities and rights as an ideal citizen of India
4. Will be able to perceive and interpret the functioning and distribution of resources between centre and state.
5. Have an awareness and relate to the existing hierarchy of the social structure, election process and Grievance redressal in a democracy.

UNIT 1

Introduction to Constitution: Meaning, reasons for having a constitution.

Evolution of the Indian Constitution: History, 1909 Act,1919 Act and 1935 Act and Premeable

Constituent Assembly: Composition and Functions;

UNIT II

Government vs Governance

- **Union Government:** Political Executive-President, Prime Minister, Council of Ministers

Bureaucratic executive.

- **State Government:** Executive: Governor, Chief Minister, Council of Ministers
- **Local Government:** Panchayat Raj Institutions, Rural and Urban local bodies-composition,

UNITIII

Rights and Duties:

Fundamental Rights, Directive Principles of State Policy, Fundamental Duties of a Good Citizen, - Public Interest Litigation (PIL)

UNIT IV

Relation between Federal and Provincial units:

Union-State relations: Administrative, legislative and Financial, Inter-State council, NITI Ayog, Finance Commission of India.

UNIT V

Constitutional and Statutory Bodies:

Election Commission and Electoral Reforms

National Human Rights Commission, National Commission for Women, National Commission for Minorities, National Commission for Protection of Child Rights.

TEXTBOOKS

1. Durga Das Basu, "Introduction to the Constitution of India", English- Hardcover: LexisNexis, New Delhi.
2. Dr. B.L. Fadia, Dr. KuldeepFadia , "Indian Government and Politics", SahithyaBhavan Publications, Agra.
3. M.Lakshmikanth, 'Indian polity', Tata McGraw Hill

REFERENCE BOOKS

1. M.V. Pylee, "Indian Constitution".
2. Qatar, "Indian Political System".
3. Constitution of India, Telugu Academy

Course Code	Course Title						Core / Elective
3PC559CS	ARTIFICIAL INTELLIGENCE LAB						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student

1. Toapplyprogrammingskillstoformulatethesolutions forcomputationalproblems.
2. Tostudyimplementationfirstorderpredicatecalculususing Prolog
3. TofamiliarizewithbasicimplementationofNLP withthehelpofPythonlibrariesNLTK
4. Tounderstandpythonlibraryscikit-learnforbuilding machinelearning models
5. ToenrichknowledgetoselectandapplyrelevantAItools forthegivenproblem

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Designanddevelopsolutionsforinformedanduninformedsearchproblems inAI.
2. Demonstratereasoninginfirstorderlogicusing Prolog.
3. Demonstrateandenrichknowledgetoselectandapplypythonlibrariestosynthesizeinformatio nanddevelop supervisedlearningmodels
4. UtilizeadvancedpackagelikeNLTKforimplementingnaturallanguageprocessing.
5. Developacasestudyinmultidisciplinaryareastodemonstrateuseof AI

List of Programs

1. Write a program for water jug problem.
2. Write program to solve 5-queens problem.
3. Write a program to implement Hangman game using python.
4. WriteaprogramtoimplementUninformedsearchtechniques:
    a. BFS
    b. DFS
5. Design and implement solution for 8-puzzle problem using Greedy Best First Search.
6. Find the shortest path between a starting location and destination location in a graph using A* search algorithm.
7. Implement MiniMax algorithm for finding an optimal decision in a tic-tac toe game
8. StudyofProlog,itsfacts,andrules.
    a. Writesimple factsforthestatementsandqueryingit.
    b. WriteaprogramforFamily-tree.
9. Write a python program to implement the methods of numpy.
10. Write a python program to create the following using pandas.
    a. Create a dataframe from the dictionary

b. List the top and bottom 10 rows from the dataframe
c. Display the dimensions
d. Access the data at index 3

11. Writeaprogramtotrainandvalidatethefollowing classifiersfor givendata(scikit-learn):
    a. DecisionTree
    b. Multi-layer FeedForwardneuralnetwork
12. TextprocessingusingNLTK
    a. Removestopwords
    b. Implementstemming
    c. POS(PartsofSpeech)tagging

Inadditiontotheaboveprograms,studentsshould beencouragedto study implementationsofoneofthefollowing

- Gamebot(TicTactoe,7puzzle)
- Expertsystem(SimpleMedicalDiagnosis)
- Textclassification
- Chatbot

Course Code	Course Title						Core / Elective
3ES551CS	DIGITAL IMAGE PROCESSING LAB						ES
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To introduce the concepts of image processing and basic analytical methods to be used in image processing.
2. To familiarize students with image enhancement and restoration techniques,
3. To explain different image compression techniques.
4. To introduce segmentation and morphological processing techniques

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand how the images are read as grayscale and RGB
2. Understand how the images are getting converted in different forms
3. Understand the processing and implement different image filtering techniques
4. Implement Edge detection
5. Compare the different DFT, DCT and DWT techniques

List of Programs:

1. OpenCV installation
2. Reading, Writing and Storing Images
3. Reading an Image as Grayscale
4. Reading Image as RGB
5. Image Conversion - Colored Images to GrayScale
6. Image Conversion - Colored Image to Binary
7. Processing – Blur – Averaging, Gaussian
8. Image Filtering - Bilateral Filter, Box Filter, Erosion
9. Thresholding – Simple, Adaptive
10. Sobel Operator
11. DFT, DCT, DWT
12. Edge Detection

Course Code	Course Title						Core / Elective
3PW560CS	SKILL DEVELOPMENT COURSE III						PW
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. Able to identify the basic components of an Android app, such as activities, layouts, and views.
2. Be able to use layouts to arrange your user interface elements in a logical and efficient way.
3. Be able to store data in the app's internal storage, or in a cloud-based storage service.
4. Able to add that feature to an existing Android app.
5. Able to deploy that app to the Google Play Store.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand the basics of Android development, including the Android Studio IDE, the Android SDK, and the AndroidManifest.xml file.
2. Create an app with multiple activities that can communicate with each other using intents.
3. Create a variety of user interface elements, such as buttons, text fields, and checkboxes.
4. Use layouts to arrange their user interface elements in a logical and efficient way.
5. Understand how to store data in Android apps, using both local and remote storage options.

List of Programs:

1. **Portable Devices Overview**

1.1. Introduction to SW development for portable devices

1.2. Overview of Portable Devices

1.3. HW & SW for Portable Devices

1.4. Applications of Portable Devices

1.5. Portable devices - Understanding HW platforms

1.5.1. HW Platforms (Processors, Peripheral devices, Sensors etc)

1.5.2. HW Platforms – Mobile Phones + Wireless

1.5.3. HW Platforms – Internet of things (IoT) + Wireless

1.5.4. Example - Rasberry Pi

1.5.5. Sensors in Portable devices

1.5.6. Generic HW platforms

2. Overview of SW Platforms & Development

2.1. Mobile OS

2.1.1. Architecture and Framework of different mobile platforms

2.1.2. Development platforms and development tools

2.1.3. Programming languages

2.1.4. Simulator and emulator

2.1.5. SDK and Development Environments

2.1.6. Development Life Cycle of Application

2.2. CREATING APPLICATIONS AND ACTIVITIES

2.2.1. Introducing the Application Manifest File

2.2.2. Creating Applications and Activities

2.2.3. Architecture Patterns (MVC)

2.2.4. Review of other Architecture and Design patterns

2.2.5. The Android Application Lifecycle

3. User Interface Design; Intents and Broadcasts

3.1. Fundamental Android UI Design

3.2. Introducing Layouts

3.3. Introducing Fragments

3.4. Introducing Intents

3.5. Creating Intent Filters and Broadcast Receivers

4. Background Services and Using Internet Resources

4.1. Introducing Services

4.2. Using Background Threads

4.3. Parsing Internet Resources

4.4. Using the Download Manager

4.5. Using Internet Services

4.6. Connecting to Google App Engine

4.7. Best Practices for Downloading Data Without Draining the Battery

5. Files, Saving States and Preferences

5.1. Shared Preferences

5.2. Introducing the Preference Framework and the Preference Activity

5.3. Static Files as Resources

5.4. Working with the File System

6. Database and Content Providers

6.1. Introducing Android Databases

6.2. Introducing SQLite

6.3. Content Values and Cursors
6.4. Working with SQLite Databases
6.5. Creating Content Providers
6.6. Using Content Providers
6.7. Case Study: Native Android Content Providers

7. **Location Based Services, Telephony and SMS**

7.1. Using Location-Based Services
7.2. Using the Emulator with Location-Based Services
7.3. Selecting a Location Provider
7.4. Using Proximity Alerts
7.5. Using the Geocoder
7.6. Example: Map-based activity
7.7. Hardware Support for Telephony
7.8. Using Telephony
7.9. Introducing SMS and MMS

8. **Hardware Support and Devices (AUDIO, VIDEO, AND USING THE CAMERA)**

8.1. Using Sensors and the Sensor Manager
8.2. Monitoring a Device's Movement and Orientation
8.3. Introducing the Environmental Sensors
8.4. Playing Audio and Video
8.5. Using Audio Effects
8.6. Using the Camera
8.7. Recording Video
8.8. Adding Media to the Media Store

TEXTBOOKS

1. Professional Android 4 Application Development, by Reto Meier, WROX Press, Wiley Publishing

REFERENCE BOOKS

1. Android Application Development, Programming with the Google SDK, by, Rick Rogers, John Lombardo, ZigurdMednieks, Blake Meike, SPD, Oreilly, ISBN10: 81-8404-733-9, ISBN13:978-81-8404-733-2

2. Hello Android, Introducing Google's Mobile Development Platform, 3rd Edition, by Ed Burnette, Pragmatic Programmers, LLC.ISBN-10: 1-934356-56-5, ISBN-13: 978-1-934356-56-2

Course Code	Course Title						Core / Elective
3HS553HS	SOFT SKILLS LAB - I						HS
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To enable the students to listen to different speakers in different contexts for various purposes and learn target language expressions.
2. To enable the students to develop confidence and interactive skills to speak professionally in different situations.
3. To enable students to learn and develop various reading skills and strategies.
4. To enable the students to develop written expression of thought and provide opportunities to explore ideas by utilizing various techniques.
5. To equip the students to develop needed confidence and interactive skills to speak professionally and acquire skills to face any Interview

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Listen to a variety of speakers and texts and will be able to comprehend and perform the required tasks.
2. Interact in a group professionally and communicate confidently in terms of both the spoken and written communication.
3. Develop the skills and strategies of reading and writing.
4. Face any Interview confidently by managing time, making decisions by speaking appropriately according to the context.
5. Demonstrate right attitude and right skills to cope with team and communicate professionally.

LIST OF EXPERIMENTS

I. Listening Skills

- Listening to different situations by Native Speakers.
- Listening to Conversations.
- Listening to Motivational Speeches**.**

II. Speaking Skills

- Describing a person or a place or a thing using relevant adjectives.
- Picture Perception
- Oral Presentations.
- Etiquette in different situations.

III. Reading Skills

- Reading different Texts
- Reading Comprehension Passages.
- Skimming and Scanning
- Paraphrasing**.**

IV. Writing Skills

- Writing Slogans related to the image.
- Communicating on Social Media.

V. Interview Skills

- Skills required to attend an Interview
- Soft Skills to be demonstrated in a Job Interview.
- Debates and Group discussions.

Suggested Readings:

1. Andrea J. Rutherford. Basic Communication Skills for Technology. Pearson Education. Inc. New Delhi.
2. Antony Jay and Ros Jay. Effective Presentation. How to be a Top Class Presenter. Universities Press. (India) Limited.1999.
3. Robert M Sherfield and etal. "Developing Soft Skills" 4th edition, New Delhi: Pearson Education,2009.
4. M.Ashraf Rizvi Effective Technical Communication, Tata McGraw-Hill Publishing Company Limited. New Delhi.

B. E. - Computer Science and Engineering

CSE Semester – VI									
S. No.	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			L	**T**	**P / D**	**Contact Hours / week**	**CIE**	**SEE**	
Theory Courses									
1	3PC609CS	Design and Analysis of Algorithms	3	0	0	3	40	60	3
2	3PC610CS	Machine Learning	3	0	0	3	40	60	3
3	3PC611CS	Automata Languages and Compiler Design	3	0	0	3	40	60	3
4	3PE6(06 TO 10) CS	Professional Elective – II	3	0	0	3	40	60	3
5	OE	Open Elective – II	3	0	0	3	40	60	3
6	3HS652HS	Effective Technical Communication(ETCE)	2	0	0	2	40	60	2
Practical / Laboratory Courses									
7	3PC661CS	Machine Learning Lab	0	0	2	2	40	60	1
8	3PC662CS	Web Technology Lab	0	0	2*2	4	40	60	2
9	3PW663CS	Mini Project	0	0	2	2	40	60	1
		Total Credits				**25**	**360**	**540**	**21**

Professional Elective - II

1	3PE606CS	Digital Forensics
2	3PE607CS	Big Data Analytics
3	3PE608CS	Software Project Management
4	3PE609CS	Scripting Languages
5	3PE610CS	Natural Language Processing

Open Elective - II

XOE602XX	Open Elective - II	Offered by
**1OE602AD	Deep Learning	AI&DS
2OE602CE	Green Building Technologies	CIVIL
**3OE602CS	Software Engineering	CSE
4OE602EE	Electric Vehicle Technology	EEE
5OE602EC	Fundamentals of IOT	ECE
6OE602ME	3D PrintingTechnologies	MECH

**** NOT APPLICABLE FOR CSE, AI&DS, AIML DEPARTMENTS**

Course Code	Course Title						Core / Elective
3PC609CS	DESIGN AND ANALYSIS OF ALGORITHMS						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. Analyze the asymptotic performance of algorithms and correctness proofs for algorithms
2. Demonstrate a familiarity with major algorithms and data structures
3. Apply important algorithmic design paradigms and methods of analysis
4. Familiarizing students with specific algorithms for a number of important computational problems like sorting, searching, and graphs, etc,
5. Introducing the concept of NP-complete problems and different techniques to deal with them

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand the basic notation for analyzing the performance of the algorithms.
2. Use divide-and-conquer techniques for solving suitable problems
3. Use greedy approach to solve an appropriate problem for optimal solution.
4. Apply dynamic programming approach to solve suitable problems
5. Understand the limitations of algorithm power and study how to cope with the limitations of algorithm power for various problems

UNIT I

Introduction & Elementary Data Structures: Introduction, Fundamentals of algorithm (Line Count, Operation Count), Analysis of algorithms (Best, Average, Worst case), Asymptotic Notations(O,Ω,Θ) Recursive Algorithms, Analysis using Recurrence Relations, Master's Theorem. Review of elementary data structures–Graphs: BFS, DFS, Articulation points, Bi-Connected Components. Sets: representation, UNION, FIND operations.

UNIT II

Divide-and-Conquer Method: The general method, Binary search, Finding maximum and minimum, Merge sort, Quick sort.

Brute Force: Knapsack, Travelling salesman problem, Convex-Hull

UNIT III

Greedy Method: Knapsack problem, Minimum spanning trees, Single source shortest path, Job sequencing with deadlines, Optimal storage on tapes, Optimal merge pattern

Dynamic programming method: All pairs shortest paths, Optimal binary search tress, 0/1 Knapsack problem, Reliability design, Travelling salesman problem,

UNIT–IV

Back tracking*:* N-queens problem, Graph coloring , Hamiltonian cycles

Branch-and-bound: FIFO & LC branch and Bound methods, 0/1 Knapsack problem, Travelling sales person

UNIT–V

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP-Complete classes, Cook's theorem, Proofs for NP Complete Problems: Clique, Vertex Cover.

TEXT BOOKS

1. Fundamentals of Computer Algorithms, Horowitz E, Sahni S, II Edition Universities Press, 2007,
2. "Introduction to Algorithms", Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and CliffordStein,III Edition ,PHI Learning Private Limited, 2012

REFERENCE BOOKS

1. Algorithm Design: Foundations, Analysis and Internet Examples, Michael T. Goodrich, Roberto Tamassia, II Edition John Wiley & Sons,2002
2. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.
3. Design and Analysis of Algorithms, S Sridhar, First Edition, Oxford

Course Code	Course Title						Core / Elective
3PC610CS	MACHINE LEARNING						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To learn the concepts of machine learning and types of learning along with evaluation metrics.
2. To study various supervised learning algorithms.
3. To learn ensemble techniques and various unsupervised learning algorithms.
4. To explore Neural Networks and Deep learning basics.
5. To learn reinforcement learning and study applications of machine learning

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Extractfeaturesthatcanbeusedforaparticularmachinelearningapproachin various applications.
2. Compareandcontrastprosandconsofvariousmachinelearningtechniquesandtogetaninsightwhen toapplyparticularmachinelearning approach.
3. Understanddifferentmachinelearningtypesalongwithalgorithms.
4. Understandhowtoapplymachinelearninginvariousapplications.
5. Applyensembletechniquesforimprovementofclassifiers

UNIT I

Introduction: Representation and Learning: Feature Vectors, Feature Spaces, LearningProblemFormulation

TypesofMachineLearningAlgorithms:ParametricandNon-parametricMachineLearningAlgorithms,Supervised,Unsupervised,Semi-Supervisedand ReinforcedLearning.

UNIT II

SupervisedAlgorithms:

Regression:LinearRegression,LogisticRegression,Evaluation Measures: SSE, RMSE, R2. Classification: Decision Tree, Naïve Bayes, K-Nearest Neighbors, Support Vector Machines,Overfitting, Training, Testing, and Validation Sets

AccuracyMetrics: The Confusion Matrix, precision, recall, F-Score, ReceiverOperator Characteristic (ROC) Curve.

UNIT III

FeatureSelection and Dimensionality Reduction

EnsembleAlgorithms:Bagging,RandomForest,Boosting

Unsupervised Learning: Cluster Analysis: Similarity Measures, categories of clustering algorithms, k-means,Hierarchical,Expectation-MaximizationAlgorithm,Fuzzyc-meansalgorithm

UNITIV

Neural Networks: Multilayer Perceptron, ActivationFunctions,
Training strategies: Back-propagation algorithm, Gradient Descent
Radial basis functions, Hopfield network, RecurrentNeuralNetworks.

UNIT V

ReinforcementLearning:overview,example:gettinglost,StateandActionSpaces,TheRewardFunction ,Discounting,ActionSelection,Policy,MarkovdecisionprocessesQ-learning,usesofReinforcement Learning Applications of Machine Learning in various fields: Text classification, ImageClassification,Speech Recognition

TEXTBOOKS

1. Machine Learning & Pattern Recognition (2014) Tom Mitchell, I Edition, McGraw-HillScience/Engineering/Math;(1997).
2. Machine Learning: An Algorithmic Perspective,Stephen Marsland,II Edition Chapman &Hall/CRC Press, 2014.

REFERENCE BOOKS

1. Machine Learning: A Probabilistic Perspective,Kevin Murphy, I Edition, MIT Press, 2012
2. Pattern Recognition and Machine Learning, Christopher Bishop, I Edition, Springer 2007
3. Machine Learning for Beginners, Chris Sebastian, Independently published, 2019.

Course Code	Course Title						Core / Elective
3PC611CS	AUTOMATA LANGUAGES AND COMPILER DESIGN						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To introduce the concept of formal specification of languages and different classes of formal languages
2. To Discuss automata models corresponding to different levels of Chomsky hierarchy
3. To Analyze and explain the behavior of push-down automata and TM.
4. Toteachconceptsoflanguagetranslationandphasesofcompilerdesign
5. ToinculcateknowledgeofparserbyparsingLLparserandLRparser
6. To demonstrate intermediate code using technique of syntax directed translation
7. To Illustrate the various optimization techniques for designing various optimizing compilers

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Explain finite state machines for modeling and their power to recognize the languages.
2. Summarize the concept of Regular languages and context free languages.
3. Construct PDAandTuringmachinesforthegivensetoflanguages.
4. BuildthelexicalandSyntaxanalyserphasesofcompiler.
5. ModelSDD'susingIntermediateRepresentations

UNIT I

Formal Language and Regular Expressions: Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Finite automata with output – Moore and Mealymachines, conversion of Moore to Mealy and Mealy to Moore

UNIT II

Context Free grammars and parsing: Context free grammars, derivation, parse trees, ambiguity, Leftmost andrightmost derivation of strings and Sentential forms, Ambiguity, left recursion and left factoring incontext free grammars, Minimization of context free grammars, Normal forms for context freegrammars,Chomskynormalform

Pushdown Automata: Introduction to Pushdown automata, Acceptance of context free languages,Acceptancebyfinalstateandacceptancebyemptystate and its equivalence, Equivalence ofcontextfree grammars and pushdown automata.

UNIT III

Turing Machine: Introduction to Turing Machine, Design of Turing machines, Types of Turing machines.

IntroductiontoCompiling:OverviewofCompilers,PhasesofaCompiler.

Lexical Analysis: The Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, LEX tool.

UNIT IV

SyntaxAnalysis: The roleof theParser, Firstand Follow,Predictive Parsing
Bottom up parsing: Shift reduce parsing,LR Parsers-SLR,Canonical LR,LALR,ParserGenerator(YACC).
Semantic Analysis: Syntax directed translation, S-attributed and L-attributed grammars
Intermediate code generation – abstract syntax tree, Three address code, Implementations

UNIT V

Run time storage: Storage organization, storage allocation strategies
Code optimization: Optimization of basic blocks, peephole optimization, flow graphs, Data flow analysis of flow graphs.
Code generation: Machine dependent code generation, Register allocation and assignment. Using DAG representation of Block.

TEXT BOOKS

1. Introduction to Automata Theory Languages and Computation, John E Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, III Edition,Pearson Education, 2011.
2. Compilers-Principles Techniques and Tool, Alfred Aho, Monica S Lam,Ravi Sethi, Jeffrey D.Ullman, II Edition,PearsonEducationIndia,2013.

REFERENCE BOOKS

1. An introduction to Formal Languages and Automata, Peter Linz, VI Edition, Jones & Bartlett, 2016
2. Principles of Compiler Design, V.Raghavan,I Edition,McGrawHillEducation,2017.
3. Theory of Computer Science – Automata Languages and Computation, Mishra and Chandrashekaran, III Edition, PHI, 2009
4. Formal Languages and Automata Theory, K.V.N.Sunitha , N.Kalyani, I Edition, TMH, 2010.
5. Introduction to Theory of Computation, Michel Sipser, II Edition, Thomson, 2012.

Course Code	Course Title						Core / Elective
3PE606CS	DIGITAL FORENSICS						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
2. To understand how to examine digital evidences such as the data acquisition, identification analysis.
3. To Understand the processing crimes and incident scenes
4. To Understand the latest computer forensic tools.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Apply forensic analysis tools to recover important evidence for identifying computer crime.
2. Understand computing investigation
3. Understand the perspective of data acquisition tools
4. Understand the process of digital crimes
5. Understand the latest computer forensic tools.

UNIT I

Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

UNIT II

Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

UNIT III

Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

UNIT IV

Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

UNIT V

Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

TEXTBOOKS

1. Computer Forensics: Incident Response Essentials, Warren G. Kruse II and Jay G. Heiser, Addison Wesley, 2002.
2. Guide to Computer Forensics and Investigations, Nelson, B, Phillips, A, Enfinger, F, Stuart, C., II Edition, Thomson Course Technology, 2006.

REFERENCE BOOKS

1. Computer Forensics, Computer Crime Scene Investigation, Vacca, J, II Edition, Charles River Media, 2005.
2. Digital Forensics Explained, Greg Gogolin, II Edition, CRC Press, 2021.
3. Cybersecurity and Digital Forensics, Challenges and Future Trends, Mangesh M Ghonge, SabyasachiPramanik, I Edition, Scrivener Publishing, 2022.

Course Code	Course Title						Core / Elective
3PE607CS	BIG DATA ANALYTICS						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. UnderstandtheBigDataPlatform andoverviewofApacheHadoop
2. ProvideHDFSConceptsandInterfacingwithHDFS
3. UnderstandMapReduceJobs
4. ProvidehandsonHadoopEco System Pig, Hive
5. Understand various Hadoop Eco Systems like Hbase,Zookeeper

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Explain the foundations, definitions, and challenges of Big Data.
2. Use Hadoop file system interfaces.
3. Program using Hadoop and Map reduce.
4. Understand various Hadoop Eco Systems like Pig, Hive.
5. Outline Hadoop Eco System using HBase, Zookeeper.

UNIT I

Introduction to Big Data and Hadoop

Types of Digital Data, Introduction to Big Data, Big Data Analytics, History ofHadoop, Apache Hadoop, Analyzing Data with UNIX tools, Analyzing Data withHadoop, Hadoop Streaming, Hadoop Echo System.

UNIT II

HDFS (Hadoop Distributed File System)

The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file systeminterfaces, Data flow, Hadoop I/O: Compression, Serialization, Avro and File-BasedData structures

UNIT III

Map Reduce, Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

UNIT IV

Hadoop Eco System-I

Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig withDatabases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.

Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.

UNIT V

Hadoop Eco System-II

HBase: HBasics, Concepts, Clients, Example, Hbase versus RDBMS.
Zookeeper: The Zookeeper Services, Zookeeper in Production.

TEXTBOOKS

1. Hadoop: The Definitive Guide, Tom White III Edition, O'Reily Media, 2012.
2. Intelligent Data Analysis,Michael Berthold, David J. Hand,I Edition, Springer, 2007.

REFERENCE BOOKS

1. Big Data and Business Analytics,Jay Liebowitz, Auerbach Publications, CRC press (2013).
2. Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop, Tom Plunkett, Mark Hornick, McGraw-Hill/Osborne Media (2013), Oracle press.
3. Mining of Massive Datasets, AnandRajaraman and Jefrey David Ulman, Cambridge University Press, 2012

Course Code	Course Title						Core / Elective
3PE608CS	SOFTWARE PROJECT MANAGEMENT						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. Tounderstand software projectplanningandevaluationtechniques
2. Toplanandmanageprojectsateachstageofthesoftwaredevelopmentlifecycle(SDLC)
3. Tolearnabouttheactivityplanningandriskmanagementprinciples
4. Toacquireskillstomanagevariousphasesinvolvedinprojectmanagement and people management

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand the basic project management concepts,framework and the process models
2. Apply appropriate software process model and software effort estimation techniques
3. Estimate risks involved in various project activities, staff andissuesrelated topeople management
4. Analyze checkpoints, project reporting structure, project progress and trackingmechanisms using project management principles

UNIT I
PROJECTEVALUATIONANDPROJECTPLANNING

Importance of Software Project Management – Activities – Methodologies –Categorization of Software Projects – Setting objectives – Management Principles –Management Control – Project portfolio Management – Cost-benefit evaluationtechnology – Risk evaluation – Strategic program Management – Stepwise ProjectPlanning

UNIT II
PROJECTLIFECYCLEANDEFFORTESTIMATION

Software process and Process Models – Choice of Process models – Rapid Applicationdevelopment – Agile methods – Dynamic System Development Method – ExtremeProgramming– Managing interactive processes – Basics of Software estimation – Effortand Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model

UNIT III
ACTIVITY PLANNING AND RISK MANAGEMENT

Objectives of Activity planning – Project schedules – Activities – Sequencing andscheduling – Network Planning models – Formulating Network Model – Forward Pass &Backward Pass

techniques – Critical path (CRM) method – Risk identification –Assessment – Risk Planning – Risk Management – – PERT technique – Monte Carlosimulation – Resource Allocation – Creation of critical paths – Cost schedules.

UNIT IV
PROJECT MANAGEMENT AND CONTROL

Framework for Management and control – Collection of data – Visualizing progress – Costmonitoring–EarnedValueAnalysis–PrioritizingMonitoring–Projecttracking–Change control – Software Configuration Management – Managing contracts – ContractManagement

UNIT V
STAFFINGINSOFTWAREPROJECTS

Managingpeople –Organizational behavior –Best methodsof staff selection– Motivation– The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethicaland Professional concerns – Working in teams – Decision making – Organizationalstructures – Dispersed and Virtual teams – Communications genres – Communicationplans – Leadership

TEXTBOOKS

1. Software Project Management, Bob Hughes, Mike Cotterell and Rajib Mall, V Edition Tata McGrawHill, NewDelhi, 2012
2. EffectiveSoftwareProjectManagement, RobertK.Wysocki, WileyPublication,2011

REFERENCE BOOKS

1. SoftwareProjectManagement, WalkerRoyce, Addison-Wesley,1998
2. Managing Global Software Projects, Gopalaswamy Ramesh, McGraw HillEducation (India), Fourteenth Reprint 2013

Course Code	Course Title						Core / Elective
3PE609CS	SCRIPTING LANGUAGES						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. Able to differentiate scripting and non- scripting languages.
2. To learn Scripting languages such as PERL, TCL/TK, python and BASH.
3. Expertise to program in the Linux environment.
4. Usage of scripting languages in IC design flow.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Describe about basics of Linux and Linux Networking
2. Utilize Linux environment and write programs for automation
3. Understand the concepts of Scripting languages
4. Create and run scripts using PERL/TCl.
5. Develop scripts using Python

UNIT I

Linux Basics: Introduction to Linux, File System of the Linux, General usage of Linux kernel & basic commands, Linux users and group, Permissions for file, directory and users, searching a file & directory, zipping and unzipping concepts.

UNIT II

Linux Networking: Introduction to Networking in Linux, Network basics & Tools, File Transfer Protocol in Linux, Network file system, Domain Naming Services, Dynamic hosting configuration Protocol & Network information Services

UNIT III

Perl Scripting: Introduction to Perl Scripting, working with simple values, Lists and Hashes, Loops and Decisions, Regular Expressions, Files and Data in Perl Scripting, References & Subroutines, Running and Debugging Perl, Modules, Object – Oriented Perl.

UNIT IV

Tcl / Tk Scripting: Tcl Fundamentals, String and Pattern Matching, Tcl Data Structures, Control Flow Commands, Procedures and Scope, Evel, Working with Unix, Reflection and Debugging, Script Libraries, Tk Fundamentals, Tk by examples, The Pack Geometry Manager, Binding Commands to X Events, Buttons and Menus, Simple Tk Widgets, Entry and List box Widgets Focus, Grabs and Dialogs

UNIT V

Python Scripting: Introduction to Python, using the Python Interpreter, More Control Flow Tools, Data Structures, Modules, Input and Output, Errors and Exceptions, Classes, Brief Tour of the Standard Library

TEXTBOOKS

1. Practical Programming in Tcl and Tk by Brent Welch, Updated for Tcl 7.4 and Tk 4.0.
2. Red Hat Enterprise Linux 4: System Administration Guide Copyright, Red Hat Inc, 2005

REFERENCE BOOKS

1. Learning Python – Mark Lutz and David Ascher, 2nd Ed., O'Reilly, 2003.
2. Learning Perl – 4 th Ed. Randal Schwartz, Tom Phoenix and Brain d foy. 2005.
3. Python Essentials – SamuelePedroni and Noel Pappin. O'Reilly, 2002.
4. Programming Perl – Larry Wall, Tom Christiansen and John Orwant, 3rd Edition, O'Reilly, 2000. (ISBN 0596000278)

Course Code	Course Title						Core / Elective
3PE610CS	NATURAL LANGUAGE PROCESSING						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To Explain text normalization techniques and n-gram language model
2. To Discuss Part of speech methods and naïve bayes classification techniques
3. To Understand word sense disambiguation techniques and process of building question answering system.
4. To Understand about grammars and their hierarchy.
5. To Introduce the concepts of chatbots, dialogue systems, speech recognition systems and text to speech recognition methods.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Apply normalization techniques on a document and evaluate a language model.
2. Implement parts of speech tagging and classification techniques on the words.
3. Establish relationships among words of a sentence using word net and also build the question answering system.
4. Understand the WSD and understand to use WORDNET.
5. Analyze chatbots, dialogue systems, and automatic speech recognition systems

UNIT I

Introduction: Regular Expressions, Text Normalization, Edit Distance: Words, Corpora, Text Normalization, Word Normalization, Lemmatization and Stemming, Sentence Segmentation, the Minimum Edit Distance Algorithm.

UNIT II

N-gram Language Models: N-Grams, Evaluating Language Model, Sampling sentences from a language model,

Sequence Labeling for Parts of Speech and Named Entities: Part-of-Speech Tagging, Named Entities and Named Entity Tagging

UNIT III

Naive Bayes and Sentiment Classification: Naive Bayes Classifiers, Training the Naive Bayes Classifier, Optimizing for Sentiment Analysis, Naive Bayes as a Language Model,

Evaluation: Precision, Recall, F-measure, Test sets and Cross-validation

UNIT IV

Word Senses and WordNet: Word Senses, Relations Between Senses, WordNet: A Database of Lexical Relations, Word Sense Disambiguation, WSD Algorithm: Contextual Embeddings.

Question Answering: Information Retrieval, IR-based Factoid Question Answering, IRbased QA: Datasets, Entity Linking, Knowledge-based Question Answering, Using Language Models to do QA, Classic QA Models.

UNIT V

Chatbots& Dialogue Systems: Properties of Human Conversation, Chatbots, GUS: Simple Frame-based Dialogue Systems, The Dialogue-State Architecture, Evaluating Dialogue Systems, Dialogue System Design,

Automatic Speech Recognition and Text-to-Speech: The Automatic Speech Recognition Task, Feature Extraction for ASR: Log Mel Spectrum, Speech Recognition Architecture

TEXTBOOKS

1. Speech and Language Processing, Dan Jurafsky and James H. Martin (Stanford.edu), 3rd Edition, Pearson Publications.
2. Natural Language Processing with Python, Analyzing Text with the Natural Language Toolkit, Steven Bird, Ewan Klein, and Edward Loper.
3. Ela Kumar, "Natural Language Processing", IKinternational Publication, second edition 2014

REFERENCE BOOKS

1. Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems, SowmyaVajjala, BodhisattwaMajumder, Anuj Gupta, HarshitSurana
2. Foundations of Statistical Natural Language Processing, Christopher Manning and HinrichSchütze
3. Natural Language Processing in Action, Understanding, Analysing, and Generating Text with Python, Hobson Lane, Cole Howard, Hannes Max Hapke
4. The Handbook of Computational Linguistics and Natural Language Processing, (Blackwell Handbooks in Linguistics) I Edition

Course Code	Course Title						Core / Elective
1OE602AD	DEEP LEARNING						OE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To Develop and Train Deep Neural Networks.
2. To Develop a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection andrecognition
3. To Build and train RNNs, work with NLP and Word Embeddings
4. To The internal structure of LSTM and GRU and the differences between them

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Feature Extraction from Image and Video Data
2. Implement Image Segmentation and Instance Segmentation in Images
3. Implement image recognition and image classification using a pretrained network (TransferLearning)
4. Traffic Information analysis using Twitter Data
5. Auto encoder for Classification & Feature Extraction

UNIT I

FundamentalsaboutDeepLearning.PerceptionLearningAlgorithms.Probabilisticmodelling. EarlyNeural Networks. How Deep Learning different from Machine Learning.Scalars. Vectors. Matrixes,Higher Dimensional Tensors. Manipulating Tensors. Vector Data.Time Series Data.Image Data.VideoData.

UNIT II

AboutNeuralNetwork.BuildingBlocksofNeuralNetwork.Optimizers.ActivationFunctions. LossFunctions. Data Pre-processing for neural networks, Feature Engineering.Overfitting and Underfitting.Hyper parameters.

UNIT III

About CNN. Linear Time Invariant. Image Processing Filtering. Building a convolutionalneuralnetwork.InputLayers,ConvolutionLayers.PoolingLayers.DenseLayers.Back propagationThroughtheConvolutionalLayer.FiltersandFeatureMaps.Backpropagation Through thePoolingLayers.DropoutLayersandRegularization.BatchNormalization. Various Activation Functions.Various Optimizers. LeNet, AlexNet, VGG16,ResNet. Transfer Learning with Image Data. TransferLearning using Inception Oxford VGGModel, Google Inception Model, Microsoft ResNet Model. RCNN, Fast R-CNN, Faster R-CNN,Mask-RCNN,YOLO

UNIT IV

About NLP & its Toolkits. Language Modeling. Vector Space Model (VSM). Continuous Bag of Words(CBOW).Skip-Gram Model for Word Embedding. Part of Speech (PoS)Global

Cooccurrence Statistics–based Word Vectors. Transfer Learning. Word2Vec. GlobalVectorsforWordRepresentationGloVe.BackpropagationThroughTime.BidirectionalRNNs (BRNN). Long ShortTerm Memory (LSTM). Bi-directional LSTM. Sequence-to-Sequence Models (Seq2Seq).GatedrecurrentunitGRU.

UNITV

AboutDeepReinforcementLearning.Q-Learning.DeepQ-Network(DQN).PolicyGradientMethods.Actor-CriticAlgorithm.AboutAutoencoding.ConvolutionalAutoEncoding.Variational

TEXTBOOKS

1. DeepLearningaPractitioner'sApproachJoshPattersonandAdamGibsonO'ReillyMedia, Inc.2017
2. LearnKerasforDeepNeuralNetworks,JojoMoolayil,Apress,2018
3. DeepLearningProjectsUsingTensorFlow2,VinitaSilaparasetty,Apress,2020

REFERENCEBOOKS

1. Deep Learning with Python, François Chollet, Manning ShelterIsland,2017
2. ProDeepLearningwithTensorFlow,SantanuPattanayak,Apress,2017

Course Code	Course Title						Core / Elective
2OE602CE	GREEN BUILDINGTECHNOLOGIES						OE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To impart knowledge of the principles behindthegreenbuildingtechnologies
2. To know the importance of sustainable use ofnaturalresourcesandenergy.
3. Tounderstandtheprinciplesofeffectiveenergyandresourcesmanagementinbuildings
4. To bring awareness of the basic criteria in thegreenbuildingratingsystems
5. To understand the methodologies to reduce,recycleandreusetowardssustainability.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Aftercompletionofthecourse,thestudentwillbeableto
2. Defineagreenbuilding,alongwithitsfeatures,benefitsandratingsystems
3. Describe the criteriaused forsite selection andwaterefficiencymethods
4. Explaintheenergyefficiencyterms and methods used in greenbuildingpractices
5. Selectmaterialsforsustainablebuiltenvironment&adoptwastemanagementmethods
6. Describe the methods used to maintain indoorenvironmentalquality

UNIT I

IntroductiontoGreenBuildings: Definitionofgreenbuildingsandsustainabledevelopment,typicalfeaturesofgreenbuildings,benefitsofgreenbuildingstowardssustainabledevelopment.Greenbuildingratingsystems –GRIHA,IGBCandLEED,overviewofthecriteriaaspertheseratingsystems.

UNITII

Siteselectionandplanning: Criteriaforsiteselection,preservationoflandscape,soilerosioncontrol,minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting,ventilation,etc.

Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, reducing landscapewater demand by proper irrigation systems, water efficient plumbing systems, water metering, waste watertreatment,recycleandreusesystems.

UNITIII

Energy Efficiency: Environmental impact of building constructions, Concepts of embodied energy, operationalenergyandlife cycle energy.

Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies,energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential(ODP) materials,wind and solar energy harvesting,energy metering and monitoring,conceptof netzerobuildings.

UNITIV

Buildingmaterials: Methodstoreduceembodiedenergyinbuildingmaterials:(a)Useoflocalbuildingmaterials(b)Useofnaturalandrenewablematerialslikebamboo,timber,rammedearth,stabilizedmudblocks,
(c)useofmaterialswithrecycledcontentsuchasblendedcements,pozzolonacements,flyashbricks,vitrifiedtiles,materialsfromagroandindustrialwaste.(d) reuseofwasteandsalvagedmaterials
WasteManagement: Handlingofconstructionwastematerials,separationofhouseholdwaste,on-siteandoff-siteorganic waste management

UNITV

IndoorEnvironmentalQualityforOccupantComfortandWellbeing: Daylighting,airventilation,exhaustsystems,lowVOCpaints,materials&adhesives,buildingacoustics.
Codesrelatedtogreenbuildings:NBC, ECBC,ASHRAE, UPC etc.

TEXTBOOKS

1. Michael Bauer, Peter Mösle and Michael Schwarz "Green Building – Guidebook for SustainableArchitecture"Springer,2010.
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment

REFERENCE BOOKS

1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers

Course Code	Course Title						Core / Elective
3OE602CS	SOFTWARE ENGINEERING						OE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. Describe and compare various software development methods and understand the context in which each approach might be applicable
2. To impart knowledge on various phases, methodologies and practices of software development
3. Toapplytheprojectmanagementandanalysisprinciplestosoftwareprojectdevelopment
4. To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metric
5. Toapplythedesign&testingprinciplestosoftwareprojectdevelopment.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Acquired working knowledge of alternative approaches and techniques for each phase of SDLC.
2. Judge an appropriate process model(s) for software project attributes and analyze requirements for project development.
3. Acquire skills necessary as an independent or as part of a team for architecting a complete software project by identifying solutions for recurring problems exerting
4. Concede product quality through testing techniques employing appropriate metrics by understanding the practical challenges associated with the development of a significant software system
5. Apply the software engineering principles in real time project development

UNIT I

Introduction to Software: Types of software**,** Characteristics of Software Attributes of good software.

Software Engineering: software engineering, Software engineering costs, key challenges facing software engineering, Systems engineering & software Engineering, SDLC.

SoftwareDevelopmentProcessModels:

PrescriptiveModels,WaterfallModel,IncrementalProcessModels,Evolutionary Process Models, Specialized Process Models, The UnifiedModels, PersonalandTeam Process Models, Process Technology,Product and Process.

UNIT II

Software Engineering Principles:SEPrinciples, Communication Principles,Planning Principles,Modelling Principles, Construction Principles, Deployment.

Software Requirement Analysis and Specification: Systemn and software requirements, Types of software requirements, Elicitation and analysis of requirements,Requirement validation, Requirement specification, Feasibility

UNIT III

BuildingtheAnalysisModel: Data ModelingConcepts,Object-OrientedAnalysis,Scenario-basedModeling,Flow-orientedModeling,Class-basedModeling.

Design Engineering: Design Process and Quality,DesignConcepts, the Design Model,

Performing User Interface Design: The Golden Rules, User Interface Analysis and Design,InterfaceAnalysis,InterfaceDesignSteps, DesignEvaluation.

UNIT IV

CreatinganArchitecturalDesign: SoftwareArchitecture,DataDesign,ArchitecturalStylesandPatterns, Architectural Design.

Coding: Programming languages and development tools,Selecting languages and tools Good programming practices, Coding Standards

UNIT V

SoftwareTestingandQualityAssurance: Verification and validation Techniques of testing Black-box and White-box testing Inspections Levels of testing Unit testing, Integration Testing, Interface testing, System testing, Alpha and beta testing, Regression testing Design of test cases, Quality management activities: Product and process quality Standards, ISO900, Capability Maturity Model (CMM), Risk management

Debugging: DebuggingTechniques,TheArtofDebugging.

CurrenttrendsinSoftwareEngineering Software Engineering for projects and products

TEXTBOOKS

1. Software Engineering: A Practitioner's Approach, Roger S. Pressman, VII Edition,McGraw Hill, 2009
2. Software Engineering.Ian Sommerville,VII edition,Addison-Wesley, 2004.
3. Fundamentals of Software Engineering Rajib Mall, V Edition, PHI, 2009.

REFERENCE BOOKS

1. Software Engineering Fundamentals, Ali Behforooz and Frederick J. Hudson, OxfordUniversity Press, 1996
2. An Integrated Approach to Software Engineering, PankajJalote, III Edition, NarosaPublishing House, 2000
3. Software Engineering, an Engineering approach- James F. Peters, WitoldPedrycz, VIII Edition, John Wiley.

Course Code	Course Title						Core / Elective
4OE602EE	ELECTRIC VEHICLESTECHNOLOGY						OE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. Know the history of electric hybrid electric vehicles (EV & HEV) and emphasize the need and importance of EV-HEV for sustainable future.
2. Introduce the fundamental concepts and principles of electric and hybrid electric vehicles drive train topologies
3. Develop a thorough understanding of the key elements of EV/HEV: Electric Machines for Propulsion Applications and Energy Sources.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. To identify and describe the history and evolvement of electric & hybrid electric vehicles to emphasize on the need and importance of EV/HEV for sustainable future.
2. To identify and describe the principles of various EV/HEVs drive train topologies along with their power flow control and fuel efficiency estimation.
3. To design and select electric propulsion system components for EV/HEV drives suitability for the desirable performance and control.
4. To compare and evaluate various energy sources and energy storage components for EV and HEV applications

UNITI

Introduction: History of electric vehicles (EV) and hybrid electric vehicles (HEV), need and importance of EV and HEV,Power/Energy suppliesrequirementsforEV/HEV applications,vehiclepowersourcecharacterization,andtransmissioncharacteristics.Vehiclemechanics–Roadwayfundamentals,vehiclekinetics,Dynamicsofvehiclemotion.

UNITII

Drive-Train Topologies:Series,Parallel,Series -Parallel and Complex configurationsof HEV,basics of hybrid tractionsystem,varioushybriddrive-train topologies,powerflowcontrolindrive-train topologies,fuelefficiencyanalysis.

UNITIII

Electrical Machines and PowerConverters forHybridand Electric Vehicles: Electric systemcomponents for EV/HEV,suitability of DC and AC machines for EV/HEV applications, AC and DC Motor drives. Permanent magnet and switchreluctancemachines,configuration andcontrolofdrives.PowerConverters-ConvertersforEVand HEVapplications.

UNITIV

Energy Sources for EV/HEV: Requirements of energy supplies and storage in EV/HEV, Review of batteries, fuel cells, flywheelsand ultra-capacitors as energy sources for EV/HEV, characteristics and comparison of energy sources for EV/HEV, hybridizationofdifferentenergysources.

UNITV

Electric Vehicles Charging Station: Type of Charging station, Selection and Sizing of charging station, Components of chargingStation and Single line diagram of charging station. Contactless inductive charging- Stationary Inductive charging, resonant andcompensationcircuittopologies.

TEXTBOOKS

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiely, USA, 2012.
2. Iqbal Hussain, Electric & Hybrid Vehicles – Design Fundamentals, 2nd Edition, CRC Press, 2011.

REFERENCEBOOKS

1. Chris Mi, M. Abdul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles: Principles and Applications with PracticalPerspective,Wiely,2011
2. SimoraOnori,HybridElectricVehiclesEnergyManagementStrategies,Springer

Course Code	Course Title						Core / Elective
5OE602EC	FUNDAMENTALSOFIOT						OE
Prerequisite	ContactHoursperWeek				CIE	SIE	Credits
	L	T	D	P			
Controllers,Communicationprotocols, web services	3	-	-	-	40	60	3

CourseObjectives:

1. Tointroducethefundamentals, applicationsandrequisiteinfrastructureofIoT.
2. TodescribeInternetprinciplesandcommunicationtechnologiesrelevanttoIoT.
3. Todiscuss hardwareandsoftwareaspectsofdesigninganIoTsystem.
4. Toexplaintheconceptsofcloudcomputinganddataanalytics.
5. Toillustratethebusinessmodelsandmanufacturingstrategiesof IoTproducts.

CourseOutcomes:

1. UnderstandthevariousapplicationsofIoTandotherenablingtechnologies.
2. ComprehendvariousprotocolsandcommunicationtechnologiesusedinIoT.
3. ConstructsimpleIoTsystemswithrequisite hardwareandp ythonprogramming.
4. Understandtherelevanceofcloudcomputinganddataanalyticstoo IoT.
5. Applythe businessmodelofIoTfromdevelopinga prototype to launchinga product.

UNIT I

Introduction to Internet of Things: Introduction to Internet of Things: Physical Design ofIoT:ThingsinIoT,IoTprotocols,LogicalDesignofIoT:IoTfunctionalBlocks,CommunicationModels, APIs,IoTenablingtechnologies:WirelessSensorNetworks,CloudComputing,BigDataAnalytics,IoTApplications:SmartHome,SmartCities,SmartEnvironment,SmartEnergy,SmartRetailandlogistics,Smart AgricultureandIndustry,SmartIndustryandsmartHealth

UNIT II

InternetPrinciplesandcommunicationtechnology: InternetCommunications:AnOverview –IP, TCP, IP protocol Suite, UDP. IP addresses – DNS, Static and Dynamic IPaddresses, MAC Addresses TCP and UDP Ports, Application Layer Protocols – HTTP,HTTPS,

UNITIII

Prototyping and Programming: Cost Vs Ease of Production, Prototypes and Production,Open-SourceVsClosedSource.PrototypingEmbeddedDevices–Sensors,Actuators,Microcontrollers, SoC, Choosing a platform, Prototyping Hardware platforms – Arduino,RaspberryPi.Prototypingthephysicaldesign– Laser Cutting,3Dprinting,CNCMilling

Introduction to Python, Data Types and Structures, Control Flow, Functions, Modules,Packages, File Handling, Date/Time Operations., Classes, Python packages for IoT, IoTPhysical DevicesandEndpoints:Raspberry Pi,Interfacesof Pi,Programmingpi withPython-ControllingLEDandLDR usingPiwithpythonprogramming.

UNIT IV

Cloud computing and Data analytics: Introduction to Cloud storage models -SAAS, PAAS,IAAS. Communication APIs, Amazon web services for IoT, Skynet IoT Messaging Platform.IntroductiontoDataAnalyticsforIoT-ApacheHadoop- Mapreducejobexecutionworkflow.

UNIT V

IoTCaseStudies: CasestudiesillustratingIoTDesign–SmartLighting,WeatherMonitoring, Smart Irrigation, Business model for IoT product manufacturing, IoT Startups,Massmanufacturing,EthicalissuesinIoT.

TEXTBOOKS:

1. InternetofThings-ConvergingTechnologiesforsmartenvironmentsandintegratedecosystems,RiverPublishers.
2. Adrian McEwen (Author), Hakim Cassimally, "Designing the Internet of Things",WileyIndiaPublishers.

REFERENCEBOOKS:

1. FundamentalsofPython, KennethALambertandB.L. Juneja, CenageLearning.
2. InternetofThings(AHands-on-Approach),VijayMadisetti,ArshdeepBahga,VPTPublisher,1st Ed.,2014.

CourseCode	CourseTitle						Core /Elective
6OE602ME	3D PRINTING TECHNOLOGIES						OE
Prerequisite	ContactHours perWeek				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSEOBJECTIVES:

1. Tounderstandthefundamentalconceptsof3DPrinting,itsadvantages&limitations.
2. ToknowthevarioustypesofSTLfileerrorsandotherdataformatsusedinadditivemanufacturingTechnology.
3. To know the working principle, advantages, disadvantages & applications of liquid,solidandpowderbased3D Printingtechnologies.
4. To know the diversified applications of 3D Printing technologies and explore themindifferentindustrialsectors.

COURSEOUTCOMES:Afterthecompletionofcoursethestudentswillbeableto:

1. Describethefundamentalsof3Dprinting,classifyandexplainadvantagesanddisadvantagesof3D Printingtechnologies.
2. SelectthesuitableCADdataformatsandsoftwareusedin3DPrintingtechnology.
3. Describe the operating principles, capabilities and limitations of liquid, solid &powderbased3D PrintingTechnologies.
4. Comparedifferent3Dprintingtechnologiesbasedontheirprocesscapabilitiesandapplications.
5. Applythecapabilitiesandknowledgeof3Dprintingindifferentindustrialsectors.

UNITI

PrototypingFundamentals: HistoricalDevelopment,Fundamentalsof3DPrinting,Advantages and Limitations of 3D Printing, commonly usedterms, 3D Printing ProcessChain, 3D Modelling, Data conversion and transmission, Checking & Preparing, Building,Post processing, Classification of 3D Printing processes, Fundamental Automated Processes,Distinctionbetween3D PrintingandConventionalMachiningProcesses.

Data Formats & Software: Data formats; conversion and transmission, STL Format, STLFile Problems, Consequence of Building Valid and Invalid Tessellated Models, STL fileRepairs, Newly Proposed Formats. Software's Features: Magics, Mimics, Solid View, Cura,ITKSnap.

UNITII

Liquid based Systems: Stereo Lithography Apparatus (**SLA**): Models and Specifications,Process,workingprinciple,photopolymers,photopolymerization,LayeringTechnology,laserandlaserscanning,Applications,AdvantagesandDisadvantages.**Polyjet:**Modelsand Specifications,Process,workingprinciple,Applications,AdvantagesandDisadvantages.**Solidgroundcuring**(**SGC**):Modelsandspecifications,Process,workingprinciple,Applications,AdvantagesandDisadvantages.

UNITIII

Solid-basedSystems:LaminatedObjectManufacturing(LOM): Modelsandspecifications,Process,workinggprinciple,Applications,AdvantagesandDisadvantages.**Fused Deposition Modelling (FDM):** Models and specifications, Process, working principle,Applications, Advantages and Disadvantages. **Multi Jet Modelling (MJM):** Models andspecifications,Process, Workingprinciple,Applications,AdvantagesandDisadvantages.

UNITIV

PowderBasedSystems:Selectivelasersintering(SLS): Modelsandspecifications,Process,workingprinciple,Applications,AdvantagesandDisadvantages.**ThreeDimensionalPrinting(3DP):**ModelsandSpecifications,Process,workingprinciple,Applications,AdvantagesandDisadvantages.**Laser EngineeredNetShaping(LENS):**Modelsandspecifications,Process,workingprinciple,Applications, AdvantagesandDisadvantages**.**

UNITV

Applications of 3D Printing : Application in Design, Application in Engineering, AnalysisandPlanning,AerospaceIndustry,AutomotiveIndustry,ElectronicIndustry,JewelleryIndustry, Coin Industry, GIS application,Construction field, Arts and Architecture, Patternforinvestmentandvacuumcasting,MedicalModelsandBioengineeringApplications:Planning andsimulation of complex surgery, Customized Implants & Prosthesis, Design andProduction Medical Devices, Forensic Science and Anthropology andWeb Based RapidPrototypingSystems.

TEXTBOOKS

1. CheeKaiChuaandKahFaiLeong,"3DPrintingandAdditiveManufacturingPrinciplesandApplications" FifthEdition,Worldscientific
2. 3DPrinting,RapidPrototyping,andDirectDigitalManufacturing"Springer,SecondEdition.

REFERENCEBOOKS:

1. IanGibson,DavidWRosen,BrentStucker,"AdditiveManufacturingTechnologies:
2. FrankW.Liou,"RapidPrototyping&EngineeringApplications"-CRCPress,Taylor&FrancisGroup.
3. RafiqNoorani,"RapidPrototyping:PrinciplesandApplicationsinManufacturing",JohnWiley &Sons.

Course Code	Course Title						Core / Elective
3HS652HS	EFFECTIVE TECHNICAL COMMUNICATION						HS
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	2	-	-	-	40	60	2

COURSE OBJECTIVES:

1. To Understand the process, features and barriers of Communication.
2. To learn the aspects of communication and Presentation.
3. To comprehend the types of official and business correspondence.
4. To analyze the techniques of Report Writing
5. Aspects of data transfer and presentation.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Handle Technical Communication effectively by overcoming barriers of communication.
2. Use different types of Professional correspondence to communicate effectively.
3. Use different types of Business and Inter Office Correspondence.
4. Acquire adequate skills drafting efficient reports
5. Enhance their skills of information transfer.

UNIT I

Introduction to Communication.
Definition, process and Channels of Communication.
ABC of Technical communication
Barriers to communication
Differences between general and Technical writing.

UNIT II

Aspects of Communication
Importance of listening and types of Listening
Types of Technical communication (Oral and Written)
Features of technical communication (Precision, relevance, format, style & Use of visual aids)
Persuasive Techniques.

UNIT III

Technical Writing-I
Emails
IOM
Business Letters - enquiry and response; compliant and Adjustment; placement of order; Cover letters/Job Application & Resume Writing.
Business Proposals.

UNIT IV

Technical Writing –II
Types of technical Reports (Informative, analytical, periodic, Special, formal and Informal)
Formal Elements of a Report
Feasibility, Project, Progress and Evaluation reports.

UNIT V
Information Transfer and Presentations
Non-verbal to verbal
Verbal to Non – Verbal
Important aspects of Oral and Visual Presentations

Suggested Reading

1. Raman, Meenakshi& Sharma, Sangeeta (2015) Technical Communication: Principles and Practice (3rd ed). New Delhi, OUP.
2. Rizvi Ashraf, M. (2017). Effective Technical Communication (2nd ed.). New Delhi, Tata Mc Grall Hill Education.
3. Sharma, R.C., & Mohan, Krishna. (2017). Business Correspondence and Report Writing: A practical approach to business& technical comunication(4th.ed.).New Delhi, Tata Mc Grall Hill Education
4. Tyagi, Kavita&Misra, Padma. (2011). Advanced Technical Communication. New Delhi,PHI Learning.
5. Jungk,Dale.(2004).Applied Writing for Technicians .New York, McGrall -Hill Higher Education

Course Code	Course Title						Core / Elective
3PC661CS	MACHINE LEARNING LAB						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

1. Demonstrationofdifferentclassifiers on different data.
2. Demonstrateensemblingofclassifiers for solving real world problems.
3. Make use of real world data to implement machine learning models

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Applymachinelearningalgorithms:datasetpreparation,modelselection, modelbuildingetc.
2. EvaluatevariousMachineLearningapproaches.
3. Usescikit-learn,KerasandTensorflowtoapplyMLtechniques.
4. Design anddevelopsolutionstorealworld problemsusingMLtechniques.
5. Applyunsupervised learningandinterprettheresults

List of Programs

1. Installationofpythonenvironment/Anaconda IDEformachinelearning:installingpythonmodules/Packageslikescikit-learn,KerasandTensorflow etc.
2. Programsinvolvingpandas,NumpyandScipylibraries.
3. Buildmodelsusinglinearregression andlogisticregression
4. Build Models using Decision tree
5. Build Models using K nearest neighbour
6. Build Models using Naïve bayes
7. Build Models using Support vector machine
8. DemonstrateClusteringusing k-means and Interprettheclustersobtained.
9. DemonstrateClusteringusing Hierarchicalalgorithms(agglomerativeand divisive) and Interprettheclustersobtained.
10. Demonstrateensembletechniqueslikeboosting,bagging andrandomforest
11. Buildaclassifier,compareitsperformancewithanensembletechniquelikerandomforest.
12. Evaluate various classification algorithms performance on a dataset using various measures like TruePositiverate, Falsepositiverate, precision, recalletc
13. Casestudyonsupervised/unsupervisedlearningalgorithms using Weka tool.

Course Code	Course Title						Core / Elective
3PC662CS	WEB TECHNOLOGY LAB						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2*2	40	60	2

COURSE OBJECTIVES:

1. To develop an ability to design and implement static and dynamic website
2. To Choose best technologies for solving web client/server problems
3. To Use JavaScript & PHP to validate form input entry
4. To Use appropriate client-side or Server-side applications
5. To Handling Cookies and Sessions using PHP, SERVLETS and JSP

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Create web pages using HTML and Cascading Styles sheets
2. Develop web applications using PHP
3. write a well formed / valid XML document
4. Write a server side java application
5. Compare Servlet and JSP concepts and apply JSP concepts to create dynamic web pages by reducing the code complexity

List of Programs

1. Develop static pages (using Only HTML) of an online book store. The pages should resemble: www.amazon.com. The website should consist the following pages.

   a) Home page

   b) Registration and user Login

   c) User Profile Page

   d) Books catalog

   e) Shopping Cart

   f) Payment By credit card

   g) Order Conformation

2. Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.

3. Create and save an XML document on the server, which contains 10 users information. Write a program,

which takes User Id as an input and returns the user details by taking the user information from the XML

document.

4. Write a PHP script to print prime numbers between 1-50.

5. PHP script to

    a. Find the length of a string.

    b. Count no of words in a string.

    c. Reverse a string.

    d. Search for a specific string.

6. Write a PHP script to merge two arrays and sort them as numbers, in descending order.

7. Write a PHP script that reads data from one file and write into another file.

8. Develop a Servlet to validate user name and password with the data stored in Servlet configuration file. Display authorized user if she/he is authorized else display Unauthorized user.

9. Write JSP Program to store student information sent from registration page into database table.

10 Develop a program to validate username and password that are stored in Database table using JSP.

TEXT BOOKS

1. Web Technologies: A Computer Science Perspective, Jeffrey C. Jackson, PearsonEducation

REFERENCE BOOKS

1. Deitel H.M. and Deitel P.J., "Internet and World Wide Web How to program", Pearson International, 2012, IV Edition.
2. J2EE: The complete Reference By James Keogh, McGraw-Hill
3. Bai and Ekedhi, The Web Warrior Guide to Web Programming, Thomson
4. Paul Dietel and Harvey Deitel," Java How to Program", Prentice Hall of India, VIII Edition
5. Web technologies, Black Book, Dreamtechpress.Gopalan N.P. and Akilandeswari J., "Web Technology", Prentice Hall of Ind.

Course Code	Course Title						Core / Elective
3PW663CS	MINI PROJECT						PW
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	40	60	1

COURSE OBJECTIVES:

1. To enhance practical and professional skills.
2. To familiarize tools and techniques of systematic literature survey and documentation
3. To expose students to industry practices and teamwork
4. To encourage students to work with innovative and entrepreneurial data

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Demonstrate the ability to synthesize and apply knowledge and skills acquired in the academic program to real world problems
2. Evaluate different solutions based on economic and technical feasibility
3. Effectively plan a project and confidently perform all aspects of project management
4. Develop and test the solution

Guidelines for Mini Project

1. The mini-project is a team activity having maximum of 3 students in a team. This is software based design work.

2. The mini project may be a combination of hardware and software

3. Mini Project should cater to a small system required in laboratory or real life.

4 After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.

6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.

7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.

8.Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.

B. E. - Computer Science and Engineering

CSE Semester - VII									
S. No.	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			L	**T**	**P / D**	**Contact Hours / week**	**CIE**	**SEE**	
Theory Courses									
1	3PC712CS	Cryptography and Network Security	3	0	0	3	40	60	3
2	3PC713CS	Deep Learning	3	1	0	4	40	60	4
3	3PC714CS	Cloud Computing	3	0	0	3	40	60	3
4	3PE7(11 TO 15) CS	Professional Elective – III	3	0	0	3	40	60	3
5	OE	Open Elective - III	3	0	0	3	40	60	3
Practical / Laboratory Courses									
6	3PC764CS	Cryptography and Network Security Lab	0	0	2	2	40	60	1
7	3PC765CS	Deep Learning Lab	0	0	2	2	40	60	1
8	3PW766CS	Project Work – I	0	0	4	4	40	60	2
9	3PW767CS	Summer Internship	-	-	-	-	40	60	2
		Total Credits				**24**	**360**	**540**	**22**

Professional Elective – III

1	3PE711CS	Mobile Computing
2	3PE712CS	Data Visualization
3	3PE713CS	Software Architecture and Design Patterns
4	3PE714CS	Full Stack Development I
5	3PE715CS	Digital marketing and E Commerce

Open Elective - II

XOE703XX	**Open Elective - II**	**Offered by**
**1OE703AD	Machine Learning	AI&DS
2OE703CE	Essentials of Road Safety Engineering	CIVIL
**3OE703CS	Human Computer Interaction	CSE
4OE703EE	Programmable Logic Controllers	EEE
5OE703EC	Medical Electronics	ECE
6OE703ME	Introduction to Robotics	MECH

****NOT APPLICABLE FOR CSE, AI&DS , AIML DEPARTMENTS**

Course Code	Course Title						Core / Elective
3PC712CS	CRYPTOGRAPHY AND NETWORK SECURITY						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To Able to understand basics of Cryptography and Network Security.
2. To understand the concept of Public key cryptography.
3. To Apply methods for authentication, access control, intrusion detection and prevention.
4. To Ability to identify information system requirements for both of them such as client and server.
5. To Identify and mitigate software security vulnerabilities in existing systems

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand various Cryptographic Techniques.
2. Apply various public key cryptography techniques.
3. Implement Hashing and Digital Signature techniques.
4. Understand the various Security Applications and implement system level security applications.
5. Describe the principles of the most widely used Internet security solutions

UNIT I

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security.

Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

UNIT II

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4.

Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.

UNIT III

Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512)

Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme.

Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure

UNIT IV

Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH)

Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security

UNIT V

E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, encapsulating security payload, Combining security associations, Internet Key Exchange

Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.

TEXTBOOKS

1. Cryptography and Network Security - Principles and Practice: William Stallings, VII Edition, Pearson Education, 2017.
2. Cryptography and Network Security: AtulKahate, Mc Graw Hill, 3rd Edition, 2017.

REFERENCE BOOKS

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, I Edition, 2011.
2. Cryptography and Network Security: ForouzanMukhopadhyay, Mc Graw Hill, III Edition, 2015.
3. Information Security, Principles, and Practice: Mark Stamp, 2nd Edition, Wiley India, 2011.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, IV Edition, McGraw-Hill Education, 2016.

Course Code	Course Title						Core / Elective
3PC713CS	DEEP LEARNING						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	-	-	40	60	4

COURSE OBJECTIVES:

1. Understand the fundamentals of neural networks.
2. Know issues in optimization of neural networks algorithms and understand regularization.
3. Learn about network architectures such as convolutional neural networks, recurrent neural networks and long short term memory cells.
4. Understand the application of deep networks to Computer Vision, NLP
5. Learn about adversarial learning models

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Demonstrate the fundamentals of neural networks and their training.
2. 2.Illustrate the optimization methods for deep neural networks.
3. 3.Differentiate between various architectures of CNNs, RNN
4. 4.Apply the relevant architecture to applications of Computer Vision and NLP
5. 5.Illustrate architecture of GANs and their applications

UNIT I

Introduction: History of Deep Learning, McCulloch Pitts Neuron, Multilayer Perceptrons(MLPs), Sigmoid Neurons, Feed Forward Neural Networks, Back propagation.

UNIT II

Activation functions:Sigmoid, ReLU, Hyperbolic Functions, Softmax

Optimization: Types of errors, bias-variance trade-off, overfitting-underfitting, Cross Validation, Feature Selection, Gradient Descent (GD), Momentum Based GD, Stochastic GD, Regularization (dropout, drop connect, batch normalization), Hyper parameters

UNIT III

Architectures of CNN: Introduction to CNNs, Architecture, Convolution/pooling layers, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet.

Vision Application: Object Detection – As classification, region proposals, RCNN, YOLOarchitectures. Case Study on application of YOLO Architecture

UNIT IV

Architectures of RNN: Introduction to RNNs, basic building blocks of RNNs and other architectural details, GRU, LSTMs Encoder Decoder Models, Seq2Seq models NLP application: Language Translation (Machine Translation) - Attention mechanism.

UNIT V

Adversarial Learning Models: Generative and discriminative models, Architectural and training details of Generative Adversarial Networks (GANs), Loss functions, Conditional GAN, RC GAN Vision Application: Image to Image Translation – pix2pix GAN

TEXTBOOKS

1. Deep Learning, Ian Goodfellow, YoshuaBengio, Aaron Courville, the MIT press, 2016
2. Learning deep architectures for AI,Foundations and trends in Machine Learning 2.1, Bengio, Yoshua, Now Publishers, 2009

REFERENCE BOOKS

1. Deep Learning, Rajiv Chopra, Khanna Book Publishing, Delhi 2020.
2. https://nptel.ac.in/courses/106/106/106106184/
3. https://www.coursera.org/specializations/deep-learning

Course Code	Course Title						Core / Elective
3PC714CS	CLOUD COMPUTING						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Computer Networks	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To provide knowledge of cloud architecture, deployment models.
2. To introduce broad perceptive of cloud services.
3. To introduce about storage and database management in cloud computing.
4. To make them understand about resource management in cloud computing
5. To make them familiar with the various cloud security issues and research trends in cloud

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Ability to understand various service delivery models of a cloud computing architecture.
2. Ability to understand the ways in which the cloud can be programmed and deployed.
3. Understand the state management database
4. Understanding cloud service providers.
5. Analyze and understand the various cloud security issues

UNITI

Introduction- Historical Development - Cloud Computing Architecture — The Cloud Reference Model — Cloud Characteristics — Cloud Deployment Models: Public, Private, Community, Hybrid Clouds - Cloud Delivery Models: IaaS, PaaS, SaaS.

UNITII

Cloud Computing Mechanism: Cloud Infrastructure Mechanism: Cloud Storage, Cloud Usage Monitor, Resource Replication — Specialized Cloud Mechanism: Load Balancer, SLA Monitor, Hypervisor, Resource Cluster, Multi Device Broker

UNIT III

State Management Database — Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System, State Management Database

UNIT IV

Security in the Cloud: Basic Concepts - Threat Agents - Cloud Security Threats - Cloud Security Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access Management. Data Security :Application Security-Virtual Machine Security .

UNIT V

Case Studies: Google App Engine(GAE) — GAE Architecture — Functional Modules o GAE — Amazon Web Services(AWS) — GAE Applications — Cloud Software Environments Eucalyptus — Open Nebula — Open Stack.

TEXTBOOKS

1. Cloud Computing, Concept, Technology and Architecture, Thomas Erl, ZaighamMahood, Ricardo Puttini, Prentice Hall, 2013.
2. Cloud Computing, A Practical Approach, Toby Velte, Anthony Velte, Robert C. Elsenpeter, Tata McGraw-Hill Edition, 2010.
3. Cloud Computing: Implementation, Management, And Security, Rittinghouse, John W., and James F. Ransome, CRC Press, 2017.

REFERENCE BOOKS

1. Cloud Computing: Principles and Paradigms, RajkumarBuyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp 2011

Course Code	Course Title						Core / Elective
3PE711CS	MOBILE COMPUTING						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Computer Networks	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To understand the basic concepts of mobile computing.
2. To learn the basics of mobile telecommunication system.
3. To be familiar with the network layer protocols and Ad-Hoc networks.
4. To know the basis of transport and application layer protocols.
5. To gain knowledge about different mobile platforms and application development

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Explain the basics of mobile telecommunication systems
2. Illustrate the generations of telecommunication systems in wireless networks
3. Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network
4. Explain the functionality of Transport and Application layers
5. Understand mobile application development using android/blackberry/ios/Windows SDK

UNIT I

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA.

UNIT II

Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover – Security.

UNIT III

Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV, Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.

UNIT IV

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA.Architecture – WML, J2ME.

UNIT V

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

TEXTBOOKS

1. Mobile Communications, Jochen Schiller,II Edition, Pearson Education, 2008.
2. FundamentalsofMobileComputing,PrasantKumarPattnaik,RajibMall, PHILearning Pvt.Ltd, 2012.
3. Mobile Computing, Raj Kamal, III Edition, Oxford University Press, 2018.
4. Mobile Computing, Asoke K Talukder, et al, Tata McGraw Hill, 2008.

REFERENCE BOOKS

1. Wireless and Mobile Networks: Concepts and Protocols,Sunilkumar, Manviet al , Wiley India, 2010.
2. Android Developers: http://developer.android.com/index.html
3. Apple Developer: https://developer.apple.com/
4. Windows Phone DevCenter : http://developer.windowsphone.com
5. BlackBerry Developer: http://developer.blackberry.com

Course Code	Course Title						Core / Elective
3PE712CS	DATA VISUALIZATION						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. Understand the concept of data foundation and types of data
2. Understand the key techniques and theory behind data visualization
3. Use effectively the various visualization structures
4. Understand the information visualization systems
5. Design and build data visualization systems

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand the key techniques and theory behind data visualization
2. Visualize the objects in different dimensions.
3. Design and process the data for Virtualization.
4. Apply the visualization techniques in physical sciences, computer science, applied mathematics and medical science.
5. Apply the virtualization techniques for research projects. (K1, K3).

UNIT I

Introduction and Data Foundation: Basics - Relationship between Visualization and Other Fields - The Visualization Process - Pseudo code Conventions - The Scatter plot.
Data Foundation - Types of Data - Structure within and between Records - Data Preprocessing - Data Sets

UNIT II

Foundations for Visualization: Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables - Historical Perspective - Taxonomies - Experimental Semiotics based on Perception Gibson ‘s Affordance theory – A Model of Perceptual Processing.
Visualization Techniques: Spatial Data: One-Dimensional Data - Two-Dimensional Data – ThreeDimensional Data - Dynamic Data - Combining Techniques.

UNIT III

Geospatial Data: Visualizing Spatial Data - Visualization of Point Data -Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial Data Visualization
Multivariate Data: Point-Based Techniques - Line- Based Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks- Displaying Arbitrary Graphs/Networks.

UNIT IV

Interaction Concepts and Techniques: Text and Document Visualization: Introduction - Levels of Text Representations - The Vector Space Model - Single Document Visualizations -Document Collection Visualizations - Extended Text Visualizations
Interaction Concepts: Interaction Operators - Interaction Operands and Spaces - A Unified Framework.

UNIT V

Data Visualization Tool: Connecting to Data, customizing a Data Source, working with aData Extract, Organize Data and Create Filters: Creating Groups in Your Data, CreatingHierarchies in Your Data, Understanding Filtering in Tableau, Filtering Your Data, Sorting YourData, Using Sets to Highlight Data.

TEXTBOOKS

1. Interactive Data Visualization Foundations, Techniques, Applications, Matthew Ward, Georges Grinstein and Daniel Keim, 2010.
2. Information Visualization Perception for Design, Colin Ware, II Edition, Margon Kaufmann Publishers, 2004
3. Communicating data with Tableau: Designing, developing, and delivering data visualizations, Jones, Ben, O'Reilly Media, Inc., 2014.

REFERENCE BOOKS

1. Information visualization – Design for interaction, Robert Spence, II Edition Pearson Education, 2007.
2. Data Visualization: Principles and Practice, Alexandru C. Telea,A. K. Peters Ltd, 2008

Course Code	Course Title						Core / Elective
3PE713CS	SOFTWARE ARCHITECTURE AND DESIGN PATTERNS						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Software Engineering	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To understand the concept of patterns and the Catalog
2. To discuss the Presentation tier design patterns.
3. To understand the Presentation tier design patterns effect on: sessions, client access, validation and consistency.
4. To understand the variety of implemented bad practices related to the Business and Integration tiers.
5. To highlight the evolution of patterns

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Identify functionality to designs while minimizing complexity.
2. Interpret what design patterns really are, and are not.
3. Make use of specific design patterns.
4. Identify bad practices related to the Business and Integration tiers
5. Design patterns to keep code quality high without overdesign

UNIT I

Envisioning Architecture: The Architecture Business Cycle, what is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views.
Creating an Architecture: Quality Attributes, achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture

UNIT II

Interactive systems and the MVC architecture: Introduction, The MVC architectural pattern, analyzing a simple drawing program, designing the system, designing of the subsystems, getting into implementation, implementing undo operation, drawing incomplete items, adding a new feature, pattern-based solutions.
Analyzing Architectures: Architecture Evaluation, Architecture design decision making, ATAM, CBAM

UNIT III

Patterns: Pattern Description, organizing catalogs, role in solving design problems, Selection and usage.

Creational and Structural patterns: Abstract factory, builder, factory method, prototype, singleton, adapter, bridge, composite, façade, flyweight, Proxy.

UNIT IV

Behavioral patterns: Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor**.**

UNIT V

Case Studies: A-7E – A case study in utilizing architectural structures, The World Wide Web - a case study in interoperability, Air Traffic Control – a case study in designing for high availability, Celsius Tech – a case study in product line development

TEXTBOOKS

1. Software Architecture in Practice, Len Bass, Pau Clements & Rick Kazman, II Edition, Pearson Education, 2003.
2. Design Patterns, Erich Gamma, Pearson Education,1995.

REFERENCE BOOKS

1. Beyond Software architecture, Luke Hohmann, Addisonwesley,2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
3. Software Design, David Budgen, II edition, Pearson education,2003
4. Head First Design patterns, Eric Freeman & Elisabeth Freeman, O'REILLY,2007.
5. Design Patterns in Java, Steven John Metsker& William C.Wake, Pearson education,2006

Course Code	Course Title				Core / Elective		
3PE714CS	FULL STACK DEVELOPMENT I				PE		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Java Programming, Python Programming, Database Management	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To Create static web pages with HTML and CSS
2. To incorporate basic interactivity using JavaScript and DOM manipulation.
3. To develop interactive user interfaces using React.js
4. To understand component-based architecture, state management, and API integration.
5. To build RESTful APIs and implement user authentication using Node.js and Express.js, integrating databases for data storage and retrieval.

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Create well-structured and semantically meaningful web pages using HTML and CSS.
2. Create web design and CSS frameworks using JavaScript
3. Develop interactive and dynamic user interfaces using React.js, including state management and routing.
4. Develop robust server-side applications and RESTful APIs using Node.js and Express.js
5. Integrate with databases and implementing authentication.

UNIT I

Foundations of Web Development: Introduction to Web Development, HTML Fundamentals: Structure and Semantic Elements, CSS Basics: Styling and Layout.

UNIT II

JavaScript Basics: Variables, Data Types, and Functions, DOM Manipulation with JavaScript, Introduction to Version Control with Git, Responsive Web Design and CSS Frameworks

UNIT III

Frontend Development with React.js: Introduction to React.js and Component-Based Architecture, JSX and Props, State and Lifecycle Methods

UNIT IV

Handling Events and Forms in React, React Router for Single Page Applications, State Management with Redux, Integrating APIs with Axios

UNIT V

Backend Development with Node.js and Express.js: Introduction to Backend Development and Node.js, Building RESTful APIs with Express.js, Middleware and Error Handling

TEXTBOOKS

1. Learning React: A Hands-On Guide to Building Web Applications Using React and Redux
2. Node.js Web Development: Server-Side Development with Node 10 Made Easy, David Herron.

REFERENCE BOOKS

1. HTML and CSS: Design and Build Websites, Jon Duckett
2. MongoDB: The Definitive Guide, Shannon Bradshaw, Eoin Brazil, and Kristina Chodorow
3. Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation, Jez Humble and David Farley

Course Code	Course Title						Core / Elective
3PE715CS	DIGITAL MARKETING AND E-COMMERCE						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. In-depth exploration of digital marketing strategies and e-commerce practices
2. Learn fundamental concepts, tools, techniques of digital marketing
3. Effective strategies for digital marketing for different business
4. Proficiency in utilizing various digital marketing channels and tools.
5. Exploring various e-commerce operations to create and manage online projects

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand the key concepts and principles of digital marketing and e-commerce.
2. Develop proficiency in utilizing various digital marketing channels and tools.
3. Analyze and evaluate digital marketing strategies for different business contexts.
4. Analyze e-commerce principles to create and manage online stores effectively.
5. Demonstrate effective communication and collaboration skills in digital marketing and e-commerce projects.

UNIT I

Introduction to Digital Marketing: Overview of digital marketing landscape, Traditional vs. digital marketing, Importance of digital marketing in modern business
Website Design and Optimization: Principles of website design and usability, User experience (UX) design, Basics of search engine optimization (SEO)

UNIT II

Content Marketing: Understanding content marketing and its role in digital strategy, Content creation, distribution, and promotion, Content marketing metrics and analytics
Social Media Marketing: Introduction to social media platforms and their features, Social media strategy development and management, Social media advertising and targeting options
Email Marketing and Automation: Email marketing fundamentals, Building email lists
Email automation and analytics Introduction to marketing analytics, Key performance indicators (KPIs), Tools for data analysis and reporting

UNIT III

Search Engine Marketing (SEM): Introduction to search engine marketing (SEM), Google Ads and Bing Ads fundamentals, Pay-per-click (PPC) advertising, Keyword research and ad targeting and bidding strategies.
Introduction to E-commerce: Introduction to e-commerce, Types of e-commerce models,E-commerce platforms and technologies

UNIT IV

Basics of e-commerce website development: Choosing the right e-commerce platform, Setting up product pages, Shopping cart functionality,Payment gateways and security- UPI, RTGS, NEFT
E-commerce Marketing Strategies: Product positioning, pricing, and branding in e-Commerce
Customer Relationship Management (CRM) in E-commerce: Importance of CRM in e-commerce personalization and customer segmentation

UNIT V

Legal and Ethical Considerations in E-commerce: Overview of e-commerce regulations and compliance, Data privacy and security in e-commerce, Ethical issues in digital marketing and e-commerce
Mobile Marketing and Trends: Mobile marketing strategies and best practices, Mobile commerce (m-commerce) trends and opportunities

TEXTBOOKS

1. Digital Marketing: Strategy, Implementation and Practice, Dave Chaffey and Fiona Ellis-Chadwick, VI Edition, Pearson Education.
2. Digital marketing excellence: planning, optimizing, and integrating online marketing. Chaffey, D., & Smith, P. R. (2017). Taylor &Francis., V Edition,Routledge
3. E-Commerce 2020: Business, Technology, Society, Kenneth C. Laudon and Carol Guercio Traver, Global Edition, Pearson Education

REFERENCE BOOKS

1. Social Media Marketing: A Strategic Approach, Melissa Barker, Donald I. Barker, and Nicholas F. Bormann, Cengage Learning
2. E-commerce Website Optimization: Why 95% of Your Website Visitors Don't Buy, and What You Can Do About It, Dan Croxen-John and Johann van Tonder, II Edition, KoganPage

Course Code	Course Title						Core / Elective
1OE703AD	MACHINE LEARNING						OE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. Tolearntheconceptsofmachinelearningandtypesoflearning
2. Tostudyvarioussupervisedlearningalgorithms.
3. Tolearnensembletechniquesandvariousunsupervisedlearningalgorithms.
4. To understand assessment methods and evaluation parameters of machine learning algorithms

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Describes types of data and their preprocessing methods
2. Describes supervised, unsupervised learning methods and their appropriate evaluation procedures and metrics
3. Applies different supervised and unsupervised machine learning algorithms to different datasets
4. Evaluates different machine learning approaches and infers the best learning model for a given scenario.

UNIT I

Introduction: Types of Machine Learning Algorithms: Parametric and Non-parametric Machine Learning Algorithms, Supervised, Unsupervised, Semi-Supervised and Reinforced Learning.
Data Objects and Attribute Types: Nominal Attributes, Binary Attributes, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes.
Basic Statistical Descriptions of Data: Measuring the Central Tendency: Mean, Median, and Mode. Measuring the Dispersion of Data: Range, Quartiles, Variance, Standard Deviation.

UNIT II

Representation and Learning: Feature Vectors, Feature Spaces
Supervised Algorithms: Regression: Linear Regression, Logistic Regression. Evaluation Measures: SSE, RMSE, R2

UNIT III

Classification: Decision Tree, Naïve Bayes, K-Nearest Neighbors, Support Vector Machines.
Evaluation of classification: cross validation, hold out The Confusion Matrix, Accuracy, precision, recall, F-Score, Receiver Operator Characteristic (ROC) Curve

UNIT IV

Unsupervised Learning: Cluster Analysis: Similarity Measures.
Categories of clustering algorithms, k-means, Hierarchical Clustering.

UNIT V
Ensemble Algorithms: Bagging, Random Forest, Boosting

TEXTBOOKS

1. Machine Learning & Pattern Recognition (2014) Tom Mitchell, I Edition, McGraw-HillScience/Engineering/Math;(1997).
2. Machine Learning: An Algorithmic Perspective,Stephen Marsland,II Edition Chapman &Hall/CRC Press, 2014.

REFERENCE BOOKS

1. Machine Learning: A Probabilistic Perspective,Kevin Murphy, I Edition, MIT Press, 2012
2. Pattern Recognition and Machine Learning, Christopher Bishop, I Edition, Springer 2007
3. Machine Learning for Beginners, Chris Sebastian, Independently published, 2019.

Course Code	Course Title						Core / Elective
2OE703CE	ESSENTIALS OF ROAD SAFETY ENGINEERING						OE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. Comprehend global and Indian road accident trends to grasp fundamental road safety principles.
2. Apply statistical and engineering tools to analyze traffic safety data effectively.
3. Design road infrastructure with safety features considering vehicle and human factors.
4. Manage traffic effectively to enhance road safety outcomes.
5. Conduct thorough road safety audits and propose evidence-based improvement strategies

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Understand fundamental principles of road safety.
2. Analyze traffic safety data using statistical methods and engineering techniques.
3. Apply geometric design principles and integrate safety features into road infrastructure.
4. Master traffic management systems to enhance road safety.
5. Conduct road safety audits and develop comprehensive safety management systems.

UNIT I

Global and Indian Road Safety Landscape: Current state of road safety, leading causes of accidents, comparison with global trends.

Accident Characteristics: Analyzing real-world accident data, understanding the "who, what, when, where, and why" of crashes.

UNIT II

Traffic Engineering Fundamentals: Traffic flow, capacity analysis, role of traffic control devices like signs and signals.

Statistical Methods for Action: Applying regression analysis and other statistical tools to identify correlations between factors and accidents, predicting high-risk areas.

UNIT III

Accident Investigations and Risk Management: Conducting thorough accident investigations, understanding root causes, and preventing future incidents.

Human Factors and Vehicle Characteristics: The impact of human behavior, perception

limitations, and vehicle design features on road safety.

Road Design for Safety: Geometric design elements influencing safety (lane width, curves, sight distance) and road equipment (guardrails, delineators).

Road Lifecycle Approach: Strategies for safe and efficient road maintenance, reconstruction, and rehabilitation

UNIT IV

Traffic Signals & Street Lighting: Principles of traffic signal design considering traffic flow and pedestrian needs. Importance of proper street lighting for nighttime safety.

Provisions for Vulnerable Users: Dedicated infrastructure and design considerations for the safety of pedestrians, cyclists, and other vulnerable road users.

The Power of Signs and Markings: Different types of road signs and pavement markings, design standards, and their role in guiding drivers and improving safety.

UNIT V

Traffic Management Systems (TMS) & Intelligent Transportation Systems (ITS): Implementing technology to improve traffic flow and mitigate accidents.

Road Safety Audits: Conducting comprehensive road safety audits to identify potential safety issues in existing or planned road infrastructure.

Safety from Start to Finish: Best practices for construction site safety, including worker protection measures and proper signage.

TEXTBOOKS

1. Sarkar, Pradip Kumar, Maitri, Vinay, Joshi, G.J., Transportation Planning: Principles, Practices And Policies, Third Edition, 2021.
2. L.R. Kadiyali, Traffic Engineering and Transport Planning, Khanna Publishers, 9th Edition, 2019.

REFERENCE BOOKS

1. Geetam Tiwari (Editor), Dinesh Mohan (Editor), Transport Planning and Traffic Safety, CRC Press, 1st edition, 2016.
2. HSS Committee, Manual on Road Safety Audit (IRC:SP-088), Indian Road Congress, First Revision, 2019.

Course Code	Course Title						Core / Elective
3OE703CS	HUMAN COMPUTER INTERACTION						OE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. To gain an overview of Human-Computer Interaction (HCI),
2. To understand user interface design and alternatives to traditional "keyboard and mouse" computing
3. To become familiar with the vocabulary associated with sensory and cognitive systems as relevant to task performance by humans
4. To apply models from cognitive psychology to predicting user performance in various human-computer interaction tasks
5. To analyze the importance of a design and evaluation methodology that begins with and maintainsa focus on the user

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Explain the capabilities of both humans and computers from the viewpoint of human information processing.
2. Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.
3. Apply an interactive design process and universal design principles to designing HCI systems.
4. Describe and use HCI design principles, standards and guidelines.
5. Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems.

UNITI

Introduction: Importance of user Interface – definition, importance of good design. Benefits of gooddesign. A brief history of Screen design.

The graphical user interface – popularity of graphics, the concept of direct manipulation, graphicalsystem, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

UNIT II

Design process – Human interaction with computers, importance of human characteristics humanconsideration, Human interaction speeds, understanding business junctions.

Screen Designing: Design goals – Screen planning and purpose, organizing screen elements, orderingof screen data and content – screen navigation and flow – Visually pleasing composition –

amount ofinformation – focus and emphasis – presentation information simply and meaningfully – informationretrieval on web – statistical graphics – Technological consideration in interface design.

UNIT III

Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colours, usesproblems, choosing colours

UNIT IV

HCI in the software process, The software life cycle Usability Engineering Iterative design andprototyping Design Focus: Prototyping in practice Design rationale Design rules Principles to supportusability Standards Golden rules and heuristics HCI patterns Evaluation techniques, Goals ofevaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing anevaluation method. Universal design, Universal design principles Multi-modal interaction

UNIT V

Cognitive models Goal and task hierarchies
Design Focus: GOMS saves money Linguistic models Thechallenge of display-based systems Physical and device models Cognitive architectures Ubiquitouscomputing and augmented realities Ubiquitous computing applications research
Design Focus: Ambient Wood – augmenting the physical Virtual and augmented reality Design Focus: Shared experience
Design Focus: Applications of augmented reality Information and data visualization
Design Focus: Getting the size right.

TEXT BOOKS

1. The essential guide to user interface design, Wilbert O Galitz, Wiley Dream Tech, 2002.
2. Human – Computer Interaction. Alan Dix, Janet Fincay, GreGoryd, Abowd, Russell Bealg, Pearson Education, 2003.

REFERENCE BOOKS

1. Designing the user interface. III Edition Ben Shneidermann, Pearson Education Asia, 2009.
2. Interaction Design Prece, Rogers, Sharps, V Edition, Wiley Dreamtech, 2019.
3. User Interface Design, Soren Lauesen, Addison-Wesley, 2004.
4. Human –Computer Interaction, D. R. Olsen, Cengage Learning, 2009.
5. Human –Computer Interaction, Smith - Atakan, Cengage Learning, 2010.

Course Code	Course Title						Core / Elective
4OE703EE	PROGRAMMABLE LOGIC CONTROLLERS						OE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

COURSE OBJECTIVES:

1. Understanding of PLC programming, ladder logic.
2. Analysis and classification of the process control
3. Understanding PLC hardware units and utilizing them

COURSE OUTCOMES:

After the completion of course the students will be able to:

1. Describe typical components of a Programmable Logic Controller.
2. State basic PLC terminology and their meanings.
3. Use latch, timer, counter, and other intermediate programming functions.
4. Explain and apply the concept of electrical ladder logic, its history, and its relationship to programmed PLC instruction.
5. Design and program a small, automated industrial production line

UNIT I

Introduction to PLC

What is PLC, concept of PLC, Building blocks of PLC, Functions of various blocks, and limitations of relays. Advantages of PLCs over electromagnetic relays. Different programming languages, PLC manufacturer etc

UNIT II

Working of PLC

Basic operation and principles of PLC, Scan Cycle, Memory structures, I/O structure, Programming terminal, power supply

UNIT III

Instruction Set

Basic instructions like latch, master control self-holding relays, Timer instruction like retentive timers, resetting of timers, Counter instructions like up counter, down counter, resetting of counters, Arithmetic Instructions (ADD,SUB,DIV,MUL etc.), MOV instruction, RTC(Real Time Clock Function), Watch Dug Timer, Comparison instructions like equal, not equal, greater, greater than equal, less than, less than equal.

UNIT IV

Ladder Diagram Programming

Programming based on basic instructions, timer, counter, and comparison instructions using ladder program.

UNIT V

Applications of PLCs

Object counter,On-off control, Car parking, Sequential starting of motors, Traffic light control, Motor in forward and reverse direction, Star-Delta, DOL Starters, Filling of Bottles,Room Automation

TEXTBOOKS

1. Programmable Logic Controller by Job Dan Otter; P.H. International, Inc, USA
2. Introduction to PLCs by Gary Dunning. McGraw Hill
3. Module on PLCs and their Applications by Rajesh Kumar, NITTTR Chandigarh

REFERENCE BOOKS

1. Programmable Logic Controller and Microcontrollers by Gurpreet Kaur and SK Sahdev by Uneek Publications, Jalandhar.
2. Module on "Allen BradlagPlC (SLC 500), Institution set-1, by Rajesh Kumar, NITTTR, Chandigarh
3. Module on "PLC Applications based on SLC 5/03" By Rajesh Kumar, NITTTR Chandigarh
4. CHUNGPA, "User's Manual: Universal PLC Training System CPS-3580U", English ver1, 2020.
5. Handbook, P. L. C. "Practical Guide to Programmable Logic Controllers." AutomationDirect. com.

Course Code	Course Title						Core/Elective
5OE703EC	MEDICAL ELECTRONICS						OE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

Course Objectives: This course aims to familiarize

1. To familiarize students with the fundamental principles of medical electronics and the nature of bioelectric signals.
2. To provide students with the knowledge and skills necessary for the acquisition, processing, and interpretation of biosignals such as ECG, EEG, EOG, and EMG.
3. To enable students to understand the common artifacts and sources of noise in biosignals and develop techniques for artifact removal.
4. To introduce students to the clinical applications of biosignal analysis in the diagnosis and monitoring of various medical conditions.
5. To foster an understanding of emerging trends and technologies in medical electronics and their potential impact on healthcare.

Course Outcomes: On successful completion of the course, the students will be able to

1. Demonstrate an understanding of the principles underlying bioelectric signals and their relevance in medical diagnostics.
2. Apply appropriate techniques for the acquisition and preprocessing of biosignals using specialized instrumentation.
3. Analyze and interpret biosignals such as ECG, EEG, EOG, and EMG to identify normal and abnormal patterns.
4. Implement signal processing algorithms to remove artifacts and enhance the quality of biosignals for accurate diagnosis.
5. Evaluate the clinical significance of biosignal analysis in the context of specific medical conditions and treatment strategies.

UNIT -I

Medical Electronics Overview: Definition, scope, and importance in healthcare. Bioelectric Signals Basics: Nature, characteristics, and acquisition techniques. Signal Processing Fundamentals: Basics and artifact removal techniques.

UNIT – II

Physiology of the Heart: Understanding the cardiac cycle and ECG signal generation. ECG Signal Acquisition: Electrodes, instruments, and techniques. ECG Interpretation: Normal/abnormal waveforms analysis. ECG Artifacts and Noise: Sources and minimization methods.

UNIT – III

Fundamentals of Brain Signals: EEG signal generation and EEG signal acquisition techniques. EEG Signal Analysis: Preprocessing, feature extraction, and classification. EEG Artifacts: Identification and mitigation strategies.

UNIT – IV

Muscle Physiology: EMG signal generation and EMG signal acquisition techniques. EMG Signal Interpretation: Normal/abnormal waveforms analysis, Noise Sources and minimization methods.

UNIT – V

Other Biosignals Introduction: EOG and EDA overview. Wearable Medical Electronics: Continuous monitoring and diagnosis applications. Medical Electronics Trends: Recent advancements and future directions. Case Studies and Practical Applications: Real-world examples.

TEXT BOOKS:

1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Engineering", 4th Edition, Academic Press, 2012.
2. C. Raja Rao and Sujoy K. Guha, "Principles of Medical Electronics and Biomedical Instrumentation", 5th Edition, McGraw Hill Education, 2018.

REFERENCE BOOKS:

1. Malcolm S. Milner, Iain Hunter, and David G. Sixto Jr., "Biomedical Signal Analysis: A Practical Guide", 3rd Edition, Artech House, 2012.
2. IEEE Transactions on Biomedical Engineering

CourseCode	CourseTitle						Core/Elective
6OE703ME	INTRODUCTION TO ROBOTICS						OE
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3

CourseObjectives:

1. Familiarize with basic terminologies of the robotic science and essential knowledge required to get started in the field of Robotics.
2. Learn different types of grippers and sensors used in robotics.
3. Understand sensor selection criteria.
4. Learn programming languages for robot programming.
5. Understand the socio economic aspects and interdisciplinary applications of robotics.

CourseOutcomes:

Aftercompletingthe course,studentwillbeable to:

1. Understand the principles and functions of robotic components.
2. Analyze the role of sensors, actuators, and controllers in robotic systems.
3. Apply kinematic principles to model and control robot movement.
4. Develop basic programming skills for robot control and simulation.
5. Understand socio economic aspects of robotics.

UNITI

Introduction to Robotics:

Brief History, Basic Concepts of Robotics such as Definition, Three laws, Types of robots, Elements of Robotic Systems , DOF, Classification of Robotic systems on the basis of various parameters such as work volume, type of drive, etc .Introduction to Principles & Strategies of Automation, Types & Levels of Automations, Need of automation, Industrial applications of robot.

UNIT II

Grippers and Sensors for Robotics:

Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper, Force analysis for various basic gripper system.

Sensors for Robots - Types of Sensors used in Robotics, Classification and applications of sensors, Selections of sensors. Need for sensors and vision system in the working and control of a robot.

UNIT III

Drives and Control for Robotics: Drive - Types of Drives, Types of transmission systems & Actuators.

Control Systems: Types of Controllers, Introduction to closed loop control.

UNIT IV

Programming and Languages for Robotics: Robot Programming: Methods of robot programming, WAIT, SIGNAL and DELAY commands, subroutines, Programming Languages, Generations of Robotic Languages, Introduction to VAL, RAIL, AML, Python, ROS etc., Development of languages since WAVE till ROS.

UNIT V

Socio-Economic aspect of Robotisation: Socio-Economical aspects for robot design, Safety for robot and standards, Introduction to Artificial Intelligence, AI techniques, Need and application of AI, New trends & recent updates in robotics.

TEXT BOOKS

1. "Robotics: Modelling, Planning and Control" by Bruno Siciliano, Springer.
2. "Introduction to Robotics: Mechanics and Control" by John J. Craig, Pearson.

REFERENCE BOOKS

1. "Robotics: Control, Sensing, Vision, and Intelligence" by C.S.G. Lee and K. S. Fu.
2. "Robot Modeling and Control" by Mark W. Spong.
3. "Robotics: Control, Sensing, Vision, and Intelligence" by C.S.G. Lee and K. S. Fu, McGraw-Hill Education.
4. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig, Pearson.

CourseCode	CourseTitle						Core/ Elective
3PC764CS	CRYPTOGRAPHY AND NETWORK SECURITY LAB						PC
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
--	-	-	-	2	40	60	1

CourseObjectives:

1. Explain the objectives of information security
2. Explain the importance and application of each of confidentiality, integrity, authentication and availability
3. Explain various encryption algorithms, hashing functions, and public key cryptology.
4. Impart knowledge on Network security

CourseOutcomes:

Aftercompletingthe course,studentwillbeable to:

1. Analyze and design classical encryption techniques and block ciphers
2. Understand data encryption standard
3. Understand the implementation of RSA algorithm
4. Implement Diffie Hellman Key exchange
5. Analyze the different network security algorithms

List of Programs:

1. Write a program that contains a string (char pointer) with a value ‘Hello world’. The program should XOR each character in this string with 0 and display the result.
2. Write a program that contains a string (char pointer) with a value ‘Hello world’. The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a program to perform encryption and decryption using the following algorithms
    a. Ceaser cipher b. Substitution cipher c. Hill Cipher
4. Write a program to implement the DES algorithm.
5. Write a program to implement the Blowfish algorithm.
6. Write the RC4 logic in Java Using Java cryptography; encrypt the text “Hello world” using Blowfish. Create your own key using Java key tool.
7. Write a program to implement the RSA algorithm.
8. Implement the Diffie-Hellman Key Exchange mechanism
9. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
10. Calculate the message digest of a text using the MD5 algorithm in JAVA

Case study analyzing the different network security algorithms

CourseCode	CourseTitle						Core/ Elective
3PC765CS	DEEP LEARNING LAB						PC
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
--	-	-	-	2	40	60	1

CourseObjectives:

1. Understand the concepts of Artificial Neural Networks and Deep Learning concepts.
2. Implement ANN and DL algorithms with Tensor flow and Keras.
3. Gain knowledge on Sequence learning with RNN.
4. Gain knowledge on Image processing and analysis with CNN
5. Get information on advanced concepts of computer vision.

CourseOutcomes:

Aftercompletingthe course,studentwillbeable to:

1. Develop ANN without using Machine Learning/Deep learning library
2. Understand the Training ANN model with back propagation
3. Develop model for sequence learning using RNN
4. Develop image classification model using ANN and CNN.
5. Generate a new image with auto-encoder and GAN

List of Programs:

1. Create Tensors and perform basic operations with tensors
2. Create Tensors and apply split & merge operations and statistics operations.
3. Design single unit perception for classification of iris dataset without using predefined models
4. Design, train and test the MLP for tabular data and verify various activation functions and optimizers tensor flow.
5. Design and implement to classify 32x32 images using MLP using tensor flow/keras and check the accuracy.
6. Design and implement a simple RNN model with tensor flow / keras and check accuracy.
7. Design and implement LSTM model with tensor flow / keras and check accuracy.
8. Design and implement GRU model with tensor flow / keras and check accuracy.
9. Design and implement a CNN model to classify multi category JPG images with tensor flow / keras and check accuracy. Predict labels for new images.
10. Design and implement a CNN model to classify multi category tiff images with tensorf low / keras and check the accuracy. Check whether your model is overfit / underfit / perfect fit and apply the techniques to avoid overfit and underfit like regulizers, dropouts etc.
11. Implement a CNN architecture (LeNet, Alexnet, VGG, etc) model to classify multi category Satellite images with tensor flow / keras and check the accuracy. Check whether your model is overfit / underfit / perfect fit and apply the techniques to avoid overfit and underfit.
12. Implement an Auto encoder to de-noise image.
13. Implement a GAN application to convert images

CourseCode	CourseTitle						Core/ Elective
3PW766CS	PROJECT WORK – I						PW
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
--	-	-	-	4	40	60	2

CourseObjectives:

1. To enhance practical and professional skills.
2. To familiarize tools and techniques of systematic literature survey and documentation
3. To expose the students to industry practices and teamwork.
4. To encourage students to work with innovative and entrepreneurial ideas.

CourseOutcomes:

Aftercompletingthe course,studentwillbeable to:

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
2. Evaluate different solutions based on economic and technical feasibility
3. Effectively plan a project and confidently perform all aspects of project management
4. Demonstrate effective written and oral communication skill
5. Communicate effectively by comprehending, documenting, making effective presentation and exchanging clear instructions

The department can initiate the project allotment procedure at the end of VI semester and finalize it inthe first two weeks of VII semester.

The department will appoint a project coordinator who will coordinate the following:

- Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries)
- Grouping of students (max 3 in a group)
- Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skillsobtained in different courses, new technologies and current industry practices. This requires students tounderstand current problems in their domain and methodologies to solve these problems. To getawareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent onspecial lectures by faculty members, research scholars, post graduate students of the department andinvited lectures by engineers from industries and R&D institutions. After completion of these seminarseach group has to formalize the project proposal based on their own ideas or as suggested by the projectguide.

Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the lastweek of the semester which should be strictly adhered to.

Each group will be required to:

1. Submit a one-page synopsis before the seminar for display on notice board.
2. Give a 30 minutes‟ presentation followed by 10 minutes‟ discussion.
3. Submit a technical write-up on the topic.

At least two teachers will be associated with the Project Seminar to evaluate students for the award ofsessional marks which will be on the basis of performance in all the 3 items stated above.
The seminar presentation should include the following components of the project:

- Problem definition and specification
- Literature survey
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of bar (activity) charts

Presentation- oral and written.

CourseCode	CourseTitle						Core/ Elective
3PW767CS	SUMMER INTERNSHIP						PW
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
--	-	-	-	-	40	60	2

CourseObjectives:

1. To train and provide hands-on experience in analysis, design, and programming of information systems by means of case studies and projects.
2. To expose the students to industry practices and teamwork.
3. To provide training in soft skills and also train them in presenting seminars and technical report writing

CourseOutcomes:

Aftercompletingthe course,studentwillbeable to:

1. Get Practical experience of software design and development, and coding practices within Industrial/R&D Environments.
2. Gain working practices within Industrial/R&D Environments.
3. Prepare reports and other relevant documentation

Summer Internship is introduced as part of the curricula of encouraging students to work on problems ofinterest to industries. A batch of three students will be attached to a person from the Government orPrivate Organisations/Computer Industry/Software Companies/R&D Organization for a period of 4-6weeks. This will be during the summer vacation following the completion of the III-year Course. Onefaculty coordinator will also be attached to the group of 3 students to monitor the progress and to interactwith the industry co- ordinate (person from industry).

The course schedule will depend on the specific internship/training experience. The typical time per topicwill vary depending on the internship

- Overview of company/project
- Safety training
- Discussions with project teams
- Background research, review of documents, white papers, and scientific papers
- Planning, designing, and reviewing the planned work
- Executing the plans
- Documenting progress, experiments, and other technical documentation
- Further team discussions to discuss results
- Final report writing and presentation

After the completion of the project, each student will be required to:

1. Submit a brief technical report on the project executed and
2. Present the work through a seminar talk (to be organized by the Department)

Award of sessional are to be based on the performance of the students at the workplace and awarded byindustry guide and internal guide (25 Marks) followed by presentation before the external examinerappointed by the university (25 Marks). One faculty member will co-ordinate the overall activity ofIndustry Attachment Program.

Note: Students have to undergo summer internship of 4-6 weeks at the end of semester VI and creditswill be awarded after evaluation in VII semester.

B. E. - Computer Science and Engineering

CSE Semester - VIII									
S. No.	**Course Code**	**Course Title**	**Scheme of Instruction**				**Scheme of Examination**		**Credits**
			L	**T**	**P / D**	**Contact Hours / week**	**CIE**	**SEE**	
Theory Courses									
1	3HS802HS	Managerial Economics and Financial Accounting	3	0	0	3	40	60	3
2	3PE8(16 TO 20)CS	Professional Elective – IV	3	0	0	3	40	60	3
3	3PE8(21 TO 25)CS	Professional Elective – V	3	0	0	3	40	60	3
Practical / Laboratory Courses									
4	3PW868CS	Project Work – II				16	50	100	8
		Total Credits				**25**	**170**	**280**	**17**

Professional Elective – IV

1	3PE816CS	Ethical Hacking
2	3PE817CS	Web Mining
3	3PE818CS	Software Requirements and Estimations
4	3PE819CS	Web and Social Media Analytics
5	3PE820CS	Blockchain Technology

Professional Elective - V

1	3PE821CS	Adhoc Sensor Networks
2	3PE822CS	Nature Inspired Computing
3	3PE823CS	Software Testing Methodologies
4	3PE824CS	Full Stack Development II
5	3PE825CS	Semantic Web and Social Networks

CourseCode	CourseTitle						Core/ Elective
3HS802HS	MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTING						HS
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3

CourseObjectives:

1. To understand responsibilities of a manager of a business undertaking.
2. To analyze various determinants influencing demand and price
3. To understand the principles of accounting and prepare Journal, Ledger, Trial Balance & Final accounts
4. To understand Financial statement Analysis
5. To evaluate & analyze the long term investments

CourseOutcomes:

Aftercompletingthe course,studentwillbeable to:

1. Determine the responsibilities & decision making in the Organization
2. Understand the various factors influencing demand & market structure
3. Understand the principles of Accounting & solve the problems
4. Analyze the Financial performance
5. Understand the capital structure & to take decision on selection of projects

UNIT I

Introduction:

ManagerialEconomics,Scope,Importanceandrelationtoothersciences,itsusefulnesstoEngineers-Basic conceptsofManagerialEconomics.

UNIT II

DemandAnalysis: Introductiontodemand,determinants,lawofdemand,itsassumptions, Elasticity of demand-price, income and cross elasticity, demand forecasting,Market competitive structure, price & output determination under perfect competition andMonopoly.

UNIT III

BasicsofAccounting: Financial Accounting–Definition-Concepts-Accounting Cycle-Journal-Ledger-Cashbook-TrialBalance.

UNIT IV

FinancialstatementAnalysis:-PreparationofFinalaccountswithsimpleadjustments (including Problems). Ratio Analysis – Importance – Liquidity andprofitabilityratios

UNIT V

Capital management: Significance and estimation of fixed and working capital requirements, sources of capital. Introduction to capital budgeting, Time Value of money - Methods: Non-Discounted cash flow methods (pay back, ARR), Discounted (NPV, PI, IRR) with problems.

TEXTBOOKS

1. ManagerialEconomics, MehtaP.L.,SultanChand&SonsPublishers.
2. ManagerialEconomics-AProblemSolvingApproach,Luke MFroeb.
3. FinancialManagement, I.M.PandayVikasPublishingHouse.
4. IntroductiontoAccountancy, MaheswariS.N. VikasPublishingHouse.

REFERENCE BOOKS

1. ManagerialEconomics,R.L.Varshney,K.L.Maheshwari,SultanPublishers.
2. ManagerialEconomics,D.M.Mithani,HimalayaPublishingHouse.
3. FinancialAccounting,Mukherjee,Hanif,TataMcGrawHill.

FinancialAccountingforManagement,Ramachandran,Kakani,TataMcGrawHill

CourseCode	CourseTitle						Core/ Elective
3PE816CS	ETHICAL HACKING						PE
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3

CourseObjectives:

1. To use the methodologies and framework of ethical hacking for enhancing the security.
2. To gain the knowledge and Impacts of Hacking; Types of Hackers; Information Security Models;
3. To understand Information Security Program; Business Perspective; Planning a Controlled Attack;
4. To understand the Framework of Steps Reconnaissance, numeration, Vulnerability Analysis.
5. To familiarize with Exploitation, Deliverable and Integration

Course Outcomes

Aftercompletingthe course,studentwillbeable to:

1. Usage and availability of tools to support an ethical hack
2. Gain the knowledge of interpreting the results of a controlled attack
3. Understand the role of politics, inherent and imposed limitations and metrics for planning of a test
4. Comprehend the dangers associated with penetration testing
5. Integrate defence Planning, Incident Management, Security Policy

UNIT I

Introduction: Hacking Impacts, The Hacker

Framework: Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, Integration.

Information Security Models: Computer Security, Network Security, Service Security, Application Security, Security Architecture.

Information Security Program: The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking.

UNIT II

The Business Perspective: Business Objectives, Security Policy, Previous Test Results, Business Challenges.

Planning for a Controlled Attack: Inherent Limitations, Imposed Limitations, Timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement.

UNIT III

Preparing for a Hack: Technical Preparation, Managing the Engagement.
Reconnaissance: Social Engineering, Physical Security, Internet Reconnaissance.

UNIT IV

Enumeration: EnumerationTechniques,SoftObjective,LookingAroundorAttack,ElementsofEnumeration,PreparingfortheNextPhase.
Exploitation: IntutiveTesting,Evasion,ThreadsandGroups,OperatingSystems,PasswordCrackers,RootKits,applications,Wardialing,Network,ServicesandAreasofConcern.

UNIT V

Deliverable:TheDeliverable,TheDocument,OveralStructure,AligningFindings,Presentation.
Integration: IntegratingtheResults,IntegrationSummary,Mitigation,DefensePlanning,IncidentManagement,SecurityPolicy,Conclusion.

TEXTBOOKS

1. TheEthicalHack:AFrameworkforBusinessValuePenetrationTesting,JamesS.Tiller,AuerbachPublications,CRCPress

REFERENCE BOOKS

1. EthicalHackingandCountermeasuresAttackPhases,EC-Council,CengageLearning
2. Hands-OnEthicalHackingandNetworkDefense, MichaelSimpson,KentBackman,JamesCorley,CengageLearning

CourseCode	CourseTitle						Core/ Elective
3PE817CS	WEB MINING						PE
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
Data Mining	3	-	-	-	40	60	3

CourseObjectives:

1. Define the World Wide Web and its history. Describe the basic concepts of data mining and web mining. Explain the difference between supervised and unsupervised learning.
2. Explain the basic concepts of information retrieval. Describe information retrieval models. Implement text and web page pre-processing techniques.
3. Describe social network analysis and its components. Explain co-citation and bibliographic coupling. Implement the Page Rank and HITS algorithms.
4. Define structured data extraction. Implement wrapper generation and induction techniques. Extract structured data from single and multiple pages.
5. Define information integration. Explain schema matching and its pre-processing. Implement domain and instance-level matching. Analyze opinion mining and sentiment analysis

Course Outcomes

Aftercompletingthe course,studentwillbeable to:

1. Develop a conceptual understanding of Web Mining through analyzing and explaining its fundamental concepts and principles.
2. Apply techniques of Information Retrieval by implementing them in practical scenarios to retrieve relevant information effectively.
3. Evaluate and assess social networks using Social Network Analysis techniques to gain insights into their structure and behavior.
4. Utilize techniques for extracting structured data from web sources, demonstrating proficiency in data extraction methodologies.
5. Synthesize information from diverse sources through schema matching and integration methods to create a unified information repository

UNIT I

Introduction: World Wide Web, History of the Web and the Internet, Introduction to Association Rule Mining, Supervised Learning & Unsupervised Learning.

Information Retrieval and Web Search: Basic Concepts of Information Retrieval, Information Retrieval Models, Relevance Feedback, Evaluation Measures, Text and Web Page Pre-Processing, Inverted Index and Its Compression, Latent Semantic Indexing, Web Search, Meta-Search: Combining Multiple Rankings, Web Spamming.

UNIT II

Social Network Analysis: Social Network Analysis: Introduction, Co-Citation and Bibliographic Coupling, Page Rank, HITS Algorithm, Community Discovery.

Web Crawling: A Basic Crawler Algorithm, Implementation Issues, Universal Crawlers, Focused Crawlers, Topical Crawlers, Evaluation, Crawler Ethics and Conflicts.

UNIT III

Structured Data Extraction: Structured Data Extraction: Wrapper Generation, Preliminaries, Wrapper Induction, Instance-Based Wrapper Learning, Automatic Wrapper Generation: Problems, String Matching and Tree Matching, Building DOM Trees, Extraction Based on a Single List Page, Extraction Based on MultiplePages.

UNIT IV

Information Integration: Introduction to Schema Matching, Pre-Processing for Schema Matching, Schema -Level Matching, Domain and Instance-Level Matching, Combining Similarities, 1: m Match, Integration of Web Query Interfaces, Constructing a Unified Global Query Interface.
Opinion Mining and Sentiment Analysis: The Problem of Opinion Mining, Document Sentiment Classification, Sentence Subjectivity and Sentiment Classification, Opinion Lexicon Expansion, Aspect- Based Opinion Mining, Opinion Search and Retrieval, Opinion Spam Detection.

UNIT V

Web Usage Mining: Data Collection and Pre-Processing, Data Modeling for Web Usage Mining, Discovery and Analysis of Web Usage Patterns, Recommender Systems and Collaborative Filtering, Query Log Mining, Computational Advertising.

TEXTBOOKS

1. Mining the Web-Discovering Knowledge from Hypertext Data, SoumenChakrabarti I Edition - October 9, 2002.
2. Data Mining the Web: Uncovering Patterns in Web Content, Structure, and Usage Zdravko Markov and Daniel T. Larose., Wiley, 2007, ISBN: 978-0-471-66655-4.

REFERENCE BOOKS

1. Data Smart: Using data science to transform information into insight, John W. Data John Wiley & Sons, 2013.
2. Mining the Social Web, Matthew Russell, O'Reilly Media, Inc., 2013

CourseCode	CourseTitle						Core/ Elective
3PE818CS	SOFTWARE REQUIREMENTS AND ESTIMATION						PE
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

CourseObjectives:

1. To introduce good practices for requirements engineering
2. To understand requirements elicitation and elicitation techniques
3. To learn the usage of analysis models and software quality attributes
4. To acquire knowledge on software estimation, size estimation, effort, schedule and cost estimation
5. Perform software project reviews and evaluation according to best practices

Course Outcomes

Aftercompletingthe course,studentwillbeable to:

1. Gain knowledge about software requirements, requirements management, their principles and practices
2. Analyze requirement elicitation techniques and prototyping
3. Gain knowledge about requirement management, their principles and practices
4. Analyze use-case modelling and different data diagrams
5. Estimate software in terms of size, cost, effort and schedule

UNIT I

SoftwareRequirements: EssentialSoftware requirement, Good practices for requirements engineering, Improvingrequirementsprocesses,Softwarerequirementsandrisk management.
SoftwareRequirementsEngineering: Requirementselicitation,requirementsanalysisdocumentation, review,elicitationtechniques,analysismodels,Softwarequalityattributes,riskreductionthroughprototyping,settingrequirementspriorities,verifyingrequirementsquality.

UNIT II

Software Requirements Management: Requirements management Principles and practices, Requirements attributes, Change Management Process, Requirements Traceability Matrix,Links in requirements chain
Software Requirements Modeling: Use Case Modeling,Analysis Models,Data flow diagram,state transition diagram, class diagrams,Object analysis,Problem Frames

UNIT III

Software Estimation: Components of Software Estimations, Estimationmethods, Problems associated with estimation, Key project factors thatinfluenceestimation.
Size Estimation: Two views of sizing, Function Point Analysis, Mark IIFPA, Full Function Points, LOC Estimation, Conversion between sizemeasures.

UNIT IV

Effort,Schedule andCost Estimation: Productivity, Estimation Factors, Approaches to Effort and Schedule Estimation,COCOMO II,Putnam Estimation Model,Algorithmic models, Cost Estimation

UNIT V

ToolsforRequirementsManagementandEstimationRequirements Management Tools: Benefits of using a requirements management tool, commercial requirements management tool, Rational Requisite pro, Caliber – RM, implementing requirements management automation.
Software Estimation Tools: Desirable features in software estimationtools, IFPUG,USC'sCOCOMOII,SLIM(SoftwareLifeCycleManagement) Tools.

TEXTBOOKS

1. Software Requirements andEstimation, SwapnaKishore, Rajesh Naik, I Edition,TataMc GrawHill,2001
2. SoftwareRequirements, KarlE. Weigers,II Edition,Microsoft Press,2003

REFERENCE BOOKS

1. Managing Software Requirements, Dean Leffingwell& Don Widrig, Pearson Education, 2003.
2. Mastering the requirements process, Suzanne Robertson & James Robertson, II Edition, Pearson Education, 2006.
3. Estimating Software Costs, Capers Jones, II Edition, TMH, 2007.

CourseCode	CourseTitle						Core/ Elective
3PE819CS	WEB AND SOCIAL MEDIA ANALYTICS						PE
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

CourseObjectives:

1. Exposure to various web and social media analytic techniques.
2. Learn basic concepts of Text Analytics and Text Mining.
3. Understand various applications of sentiment analysis.
4. Expertise on Web Usage Mining
5. Understand sources and limitations of web based data

Course Outcomes

Aftercompletingthe course,studentwillbeable to:

1. Knowledge on decision support systems.
2. Apply natural language processing concepts on text analytics.
3. Understand sentiment analysis.
4. Knowledge on search engine optimization and web analytics
5. Understand on Social media Analytics and Social Network analysis

UNIT I

An Overview of Business Intelligence, Analytics, and Decision Support: Analytics to Manage a Vaccine Supply Chain Effectively and Safely, Changing Business Environments and Computerized Decision Support, Information Systems Support for Decision Making, The Concept of Decision Support Systems (DSS), Business Analytics Overview, Brief Introduction to Big Data Analytics.

UNIT II

Text Analytics and Text Mining: Machine Versus Men on Jeopardy: The Story of Watson, Text Analytics and Text Mining Concepts and Definitions, Natural Language Processing, Text Mining Applications, Text Mining Process, Text Mining Tools

UNIT III

Sentiment Analysis: Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process, Sentiment Analysis and Speech Analytics.

UNIT IV

Web Analytics, Web Mining: Security First Insurance Deepens Connection with Policyholders, Web Mining Overview, Web Content and Web Structure Mining, Search Engines, Search Engine Optimization, Web Usage Mining (Web Analytics), Web Analytics Maturity Model and Web Analytics Tools

UNIT V

Social Analytics and Social Network Analysis: Social Analytics and Social Network Analysis, Social Media Definitions and Concepts, Social Media Analytics. Prescriptive Analytics - Optimization and Multi-Criteria Systems: Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking

TEXTBOOKS

1. Business Intelligence and Analytics: Systems for Decision Support, Ramesh Sharda, DursunDelen, Efraim Turban, Pearson Education
2. Beyond Software Architecture, Luke Hohmann, Addison wesley,2003

REFERENCE BOOKS

1. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
2. Software Design,David Budgen, II Edition,Pearson education,2003

CourseCode	CourseTitle						Core/ Elective
3PE820CS	BLOCKCHAIN TECHNOLOGY						PE
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

CourseObjectives:

1. To Understand basic concepts of blockchain
2. To gain knowledge on cryptography related to blockchain
3. To understand the usage of Bitcoin.
4. To understand the concept of Etherum
5. To become familiar with security features in blockchain technology

Course Outcomes

Aftercompletingthe course,studentwillbeable to:

1. Describe the basic concepts and technology used for blockchain.
2. Describe the primitives of the distributed computing and cryptography related to blockchain.
3. Illustrate the concepts of Bitcoin and their usage
4. Implement Ethereum block chain contract.
5. Apply security features in blockchain technologies.

UNIT I

Introduction: Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalabilityproblems, Nakamoto's concept with Blockchain based cryptocurrency,Technologies Borrowed in Blockchain – hash pointers, consensus, byzantinefault-tolerant distributed computing, digital cash etc

UNIT II

Basic Distributed Computing & Crypto primitives: Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems

UNIT III

Bitcoin basics: Bitcoin blockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use

UNIT IV

Ethereum basics: Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, using smart contracts to enforce legal contracts, comparingBitcoin scripting vs. Ethereum Smart Contracts, writing smart contracts using Solidity & JavaScript

UNIT V

Privacy, Security issues in Blockchain: Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks
Case Studies: Block chain in Financial Service, Supply Chain Management and Government Services

TEXTBOOKS

1. Bitcoin and Cryptocurrency Technologies a Comprehensive Introduction, Narayanan, Bonneau, Felten, Miller and Goldfeder, Princeton University Press.
2. Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming, Josh Thompson, Create Space Independent Publishing Platform, 2017.
3. Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, Imran Bashir, Packt Publishing.

REFERENCE BOOKS

1. Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols, MerunasGrincalaitis, Packt Publishing.

CourseCode	CourseTitle						Core/ Elective
3PE821CS	ADHOC SENSOR NETWORKS						PE
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
Computer Networks and Design & Analysis of Algorithms	3	-	-	-	40	60	3

CourseObjectives:

1. To learn Adhoc network and Sensor network fundamentals
2. To understand different routing protocols
3. To Have an in-depth knowledge on Sensor network architecture and design issues
4. To understand transport layer and security issues in Adhoc and Sensor networks
5. To have an exposure to mote programming platforms and tools**Course Outcomes**

Aftercompletingthe course,studentwillbeable to:

1. Identify the basics of Adhoc networks and Wireless Sensor Networks
2. Classify various routing protocols
3. Apply the knowledge to identify appropriate physical and MAC layer protocols
4. Assess transport layer security issues in Adhoc and sensor networks.
5. Explain the OS used in Wireless Sensor Networks and build basic modules

UNIT I

ADHOC NETWORKS–INTRODUCTION AND ROUTING PROTOCOLS:

Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Adhoc networking, Adhoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols,Table Driven Routing Protocols– Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).

UNIT II

SENSOR NETWORKS–INTRODUCTION &ARCHITECTURES:

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture – Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

UNIT III

WSN NETWORKING CONCEPTS AND PROTOCOLS:

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts – S-MAC, The Mediation Device Protocol, Contention based protocols – PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols, Energy Efficient Routing, Challenges and Issues in Transport layer protocol.

UNIT IV

SENSOR NETWORK SECURITY:

Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks,possiblesolutionsforjamming,tampering, blackholeattack,floodingattack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks.

UNIT V

SENSOR NETWORK PLATFORMS AND TOOLS:

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level softwareplatforms–TinyOS,nesC,CONTIKIOS,Node-levelSimulators–NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.

TEXT BOOKS

1.Ad Hoc Wireless Networks Architectures and Protocols, C. Siva Ram Murthy and B. S. Manoj, PrenticeHall,PTR, 2004.
2.Wireless Sensor Networks Technology,Protocols and Applications, KazemSohraby,DanielMinoli, &TaiebZnati, John Wiley, 2007.

REFERENCE BOOKS

1. AdHoc& Sensor Networks:Theory and Applications , Carlos De MoraisCordeiro, Dharma Prakash Agrawal, World Scientific Publishing Company, 2006.
2. Protocols and Architecture for Wireless Sensor Networks, Holger Karl, Andreas WilligJohn Wiley and Sons, Ltd, 2005.

CourseCode	CourseTitle						Core/ Elective
3PE822CS	NATURE INSPIRED COMPUTING						PE
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

CourseObjectives:

1. To understand NP hard problems and the need for approximation algorithms.
2. To understand algorithms that include operators, representations, fitness functions.
3. To Design algorithms that utilize the collective intelligence of simple organisms to solve problems.
4. To understand nature inspired algorithms based on Immune system and new natural materials

Course Outcomes

Aftercompletingthe course,studentwillbeable to:

1. Understand concepts of NP-hardness and computational complexity
2. Understand the appropriateness of nature-inspired algorithms.
3. Apply nature-inspired algorithms to optimization, design and learning problems.
4. Understand nature inspired algorithms based on Immune system
5. Understand the theory behind the design of DNA computing and their potential applications

UNIT I

Introduction: From Nature to Nature Computing, Philosophy, Three Branches: A BriefOverview, Individuals, Entities and agents - Parallelism andDistributivity, Interactivity, Adaptation, Feedback-Self-Organization-Complexity, Emergence and, Bottom-up Vs Top-Down- Determination, Chaos and Fractals

UNIT II

Computing Inspired by Nature: Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm, Genetic Algorithms, Reproduction-Crossover, Mutation, Crossover and Mutation rates – Selection mechanisms, Fitness proportionate, ranking and tournament selection, Building Block, Hypothesis and Schema Theorem

UNIT III

Swarm Intelligence: Introduction - Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge, Particle Swarm Optimization (PSO)
Collective Systems: Hybrid PSO algorithms, Artificial Bee Colony, Firefly Algorithm

UNIT IV

Immunocomputing: Introduction- Immune System, Physiology and main components, Pattern Recognition and Binding, Immune Network Theory- Danger Theory, Evaluation Interaction-Immune Algorithms, Introduction – Genetic algorithms, Bone Marrow Models, Forest's Algorithm, Artificial Immune Networks.

UNIT V

Computing with New Natural Materials: DNA Computing: Motivation, DNA Molecule, Adleman's experiment, Test tube programming language, Universal DNA Computers, PAM Model, Splicing Systems, Lipton's Solution to SAT Problem, Scope of DNA Computing, From Classical o DNA Computing.

TEXTBOOKS

1. Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications,Leandro Nunes de Castro, Chapman & Hall/ CRC, Taylor and Francis Group, 2007
2. Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies,Floreano D. and Mattiussi C, MIT Press, Cambridge, MA, 2008.
3. Handbook of Nature-Inspired and Innovative Computing, Albert Y.Zomaya, Springer, 2006.

REFERENCE BOOKS

1. Ant Colony Optimization, Marco Dorrigo, Thomas Stutzle, PHI,2005
2. Recent Developments in Biologically Inspired Computing, Leandro Nunes De Castro, Fernando Jose VonZuben, Idea Group Publishing, 2005.

CourseCode	CourseTitle						Core/ Elective
3PE823CS	SOFTWARE TESTING METHODOLOGIES						PE
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

CourseObjectives:

1. To study fundamental concepts in software testing, software testing issues and solutions.
2. To understand planning a test project, design test cases and data, conduct testing operations, manage software problems and defects.
3. To understand how to generate a testing report
4. To write software testing documents
5. To understand modern software testing tools.

Course Outcomes

Aftercompletingthe course,studentwillbeable to:

1. Apply software testing knowledge and engineering methods and design a software test process for a software testing project.
2. Identify the needs of software test automation,
3. Identify and define and develop a test tool to support test automation.
4. Understand and identify various software testing problems.
5. Designing and selecting software test models, criteria, strategies, and methods.

UNITI

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.

UNITII

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, 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, specifications. State, State Graphs and Transition testing: State graphs, good & bad state graphs, state testing, Testability tips.
Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools.

UNIT V

JMeter and Winrunner: Usage of JMeter and Winrunner tools for functional / Regression testing, use of Selenium tool for web testing, creation of test script for unattended testing, synchronization of test case, Rapid testing, Performance testing of a data base application and HTTP connection for website access.

TEXTBOOKS

1. Software Testing Techniques, BarisBeizer, Dreamtech Press, 2003.
2. Software Testing Tools: Covering WinRunner, Silk Test, LoadRunner, JMeter and TestDirector with case studies,Dr.K.V.K.K.Prasad, Dreamtech press, 2004.

REFERENCE BOOKS

1. The craft of software testing, BrianMarick, Prentice-Hall, Inc., 1994.
2. Software testing,Desikan, Srinisvasan, and Gopalaswamy Ramesh, Pearson Education India, 2006.
3. Software Testing in the Real World, Edward Kit, ACM Press/Addison-Wesley Publishing Co., 1995.
4. Effective methods of Software Testing, Perry William, John Wiley & Sons, 2007.

CourseCode	CourseTitle						Core/ Elective
3PE824CS	FULL STACK DEVELOPMENT II						PE
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
Full Stack Development I	3	-	-	-	40	60	3

CourseObjectives:

1. To understand MongoDB
2. To master advanced database management techniques, including schema design,
3. To understand error handling and containerization for scalable deployment.
4. To deploy web applications on cloud platforms, implement testing methodologies
5. To apply project management techniques for efficient software development.

Course Outcomes

Aftercompletingthe course,studentwillbeable to:

1. Demonstrate proficiency in MongoDB
2. Develop backend modelling in MongoDB
3. Understand Database management, including designing and querying databases, both SQL and NoSQL
4. Implement advanced backend functionalities such as authentication and error handling.
5. Implement testing strategies, and manage software projects using modern development methodologies.

UNIT I

Introduction to Databases: SQL vs NoSQL, working with MongoDB, Authentication and Authorization with JWT, Testing APIs with Postman.

UNIT II

Advanced Backend Development and Database Management: Data Modeling and Relationships in MongoDB, Advanced Querying and Aggregation in MongoDB

UNIT III

SQL Database Design and Normalization, Working with Relational Databases (e.g., MySQL, PostgreSQL), Handling Authentication with Passport.js, Error Handling and Logging in Node.js, Introduction to Docker for Containerization

UNIT IV

Deployment, Testing, and Project Management: Continuous Integration and Continuous Deployment (CI/CD), Deploying Applications to Cloud Platforms (e.g., Heroku, AWS)

UNIT V

Introduction to Testing: Unit Testing and Integration Testing, End-to-End Testing with Cypress, Introduction to Agile Development and Scrum, Managing Projects with Trello or Jira

TEXTBOOKS

1. Learning React: A Hands-On Guide to Building Web Applications Using React and Redux
2. Node.js Web Development: Server-Side Development with Node 10 Made Easy, David Herron.

REFERENCE BOOKS

1. HTML and CSS: Design and Build Websites, Jon Duckett
2. MongoDB: The Definitive Guide, Shannon Bradshaw, Eoin Brazil, and Kristina Chodorow
3. Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation, Jez Humble and David Farley

CourseCode	CourseTitle						Core/ Elective
3PE825CS	SEMANTIC WEB AND SOCIAL NETWORKS						PE
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	3

CourseObjectives:

1. To learn Web Intelligence
2. To learn Knowledge Representation for the Semantic Web
3. To learn Ontology Engineering
4. To learn Semantic Web Applications, Services and Technology
5. To learn Social Network Analysis and semantic web.

Course Outcomes

Aftercompletingthe course,studentwillbeable to:

1. Ability to understand and knowledge representation for the semantic web
2. Ability to create ontology
3. Understand the basics of Semantic Web and Social Networks.
4. Ability to understand the various Semantic web technologies
5. Develop social-semantic applications

UNIT I

Web Intelligence Thinking and Intelligent Web Applications, The Information Age, The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.

UNIT II

Knowledge Representation for the Semantic Web Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web – Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), XML/XML Schema.

UNIT III

Ontology Engineering Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping.

UNIT IV

Semantic Web Applications, Services and Technology Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods.

UNIT V

Social Networks Analysis (SNA): Introduction, Definition, Importance, Historical Overview of SNA. Levels of SNA, Network Measures. Link Analysis: Page Rank, DivRank and SimRank. Applications and case studies.

TEXT BOOKS

1. Thinking on the Web, Berners Lee, Godel and Turing, Wiley inter science, 2008.
2. Social Network Analysis, Tanmoy Chakraborty, Wiley, 2021.

CourseCode	CourseTitle						Core/ Elective
3PW868CS	PROJECT WORK – II						PW
Prerequisite	ContactHoursperWeek				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	16	50	100	8

CourseObjectives:

1. To enhance practical and professional skills.
2. To familiarize tools and techniques of systematic literature survey and documentation
3. To expose the students to industry practices and teamwork.
4. To encourage students to work with innovative and entrepreneurial ideas.

Course Outcomes

Aftercompletingthe course,studentwillbeable to:

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
2. Evaluate different solutions based on economic and technical feasibility
3. Effectively plan a project and confidently perform all aspects of project management
4. Demonstrate effective written and oral communication skills

The aim of Project work –II is to implement and evaluate the proposal made as part of Project Work - I. Students can also be encouraged to do full time internship as part of project work-II based on the common guidelines for all the departments. The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

1. Re-grouping of students - deletion of internship candidates from groups made as part ofproject Work-I
2. Re-Allotment of internship students to project guides
3. Project monitoring at regular intervals

All re-grouping/re-allotment has to be completed by the 1st week of VIII semester so that students getsufficient time for completion of the project.All projects (internship and departmental) will be monitored at least twice in a semester through studentpresentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee
comprising of faculty members as well as by the supervisor. The first review of projects for 25 marks canbe conducted after completion of five weeks. The second review for another 25 marks can be conductedafter 12 weeks of instruction.
Common norms will be established for the final documentation of the project report by the respectivedepartments. The students are required to submit draft copies of their project report within one week aftercompletion of instruction.

Note: Three periods of contact load will be assigned to each project guide.