Program Structure

for

B. E

Artificial Intelligence and Data Science

Scheme of Instruction and Syllabus

Scheme of Instruction & Examination
B. E. - Artificial Intelligence and Data Science

AI&DS 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	1BS101HS	Engineering Mathematics - 1	3	1	0	4	40	60	4
2	1BS104HS	Applied Physics	3	1	0	4	40	60	4
3	1ES101CS	Programming for Problem Solving	3	0	0	3	40	60	3
4	1ES101EE	Elements of Electrical and Electronics Engineering	3	0	0	3	40	60	3
5	1MC101CE	Environmental Science	2	0	0	2	40	60	0
Practical / Laboratory Courses									
6	1BS151HS	Applied Physics Lab	0	0	3	3	40	60	1.5
7	1ES151CS	Programming for Problem Solving Lab	0	0	2	2	40	60	1
8	1ES151EE	Elements of Electrical and Electronics Engineering Lab	0	0	2	2	40	60	1
9	1ES151CE	Engineering Graphics Lab	1	0	4	5	40	60	3
		Total Credits				**28**	**360**	**540**	**20.5**

AI&DS 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	1BS202HS	Engineering Mathematics – II	3	1	0	4	40	60	4
2	1BS206HS	Chemistry	3	1	0	3	40	60	4
3	1HS201HS	English	2	0	0	4	40	60	2
4	1ES202CS	Data Structures	3	0	0	3	40	60	3
Practical / Laboratory Courses									
5	1BS253HS	Chemistry Lab	0	0	3	3	40	60	1.5
6	1HS251HS	English Lab	0	0	2	2	40	60	1
7	1ES252CS	Data Structures lab	0	0	2	2	40	60	1
8	1ES252ME	Engineering Workshop Practice	0	0	4	5	40	60	2
9	1MC251SP	Yoga / NSS / Sports	0	0	2	2	40	-	0
		Total Credits				**28**	**360**	**480**	**18.5**

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AI&DS 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	1BS305HS	Probability and Statistics	3	1	0	4	40	60	4
2	1PC301AD	Discrete Mathematics	3	0	0	3	40	60	3
3	1PC302AD	Database Management Systems	3	0	0	3	40	60	3
4	1PC303AD	Computer Organization and Microprocessor	3	0	0	3	40	60	3
5	1ES301EC	Switching Theory and Logic Design	3	0	0	3	40	60	3
6	1MC302HS	Essence of Indian Traditional Knowledge	2	0	0	2	40	60	0
Practical / Laboratory Courses									
7	1PC351AD	Database Management Systems Lab	0	0	2	2	40	60	1
8	1PC352AD	Python Programming Lab	0	0	2 *2	4	40	60	2
9	1PC353AD	Computer Organization and Microprocessor Lab	0	0	2	2	40	60	1
10	1PW354AD	Skill Development Course- I	0	0	2	2	40	60	1
		Total Credits				**28**	**400**	**600**	**21**

AI&DS 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	1PC404AD	Operating Systems	3	0	0	3	40	60	3
2	1PC405AD	Statistical Analytics and Computing	3	0	0	3	40	60	3
3	1PC406AD	Foundations of AI	3	1	0	4	40	60	4
4	1PC407AD	Software Engineering	3	0	0	3	40	60	3
5	1HS403HS	Human Values and Professional Ethics	2	0	0	2	40	60	2
Practical / Laboratory Courses									
6	1PC455AD	Operating Systems Lab	0	0	2	2	40	60	1
7	1PC456AD	Java Programming Lab	0	0	2*2	4	40	60	2
8	1PC457AD	Statistical Analytics and Computing using Python Lab	0	0	2	2	40	60	1
9	1PW458AD	Skill DevelopmentCourse - II	0	0	2	2	40	60	1
		Total Credits				**25**	**360**	**540**	**20**

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AI&DS 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	1PC508AD	Design and Analysis of Algorithms	3	1	0	4	40	60	4
2	1PC509AD	Data Science	3	0	0	3	40	60	3
3	1ES501CS	Digital Image Processing	3	0	0	3	40	60	3
4	1PE5(01 to 05) AD	Professional Elective – I	3	0	0	3	40	60	3
5	OE	Open Elective – I	3	0	0	3	40	60	3
6	1MC503HS	Indian Constitution	3	0	0	3	40	60	0
Practical / Laboratory Courses									
7	1PC559AD	Data Science Lab	0	0	2	2	40	60	1
8	1ES551CS	Digital Image Processing Lab	0	0	2	2	40	60	1
9	1HS553HS	Soft Skills Lab-I	0	0	2	2	40	60	1
10	1PW560AD	Skill DevelopmentCourse - III	0	0	2	2	40	60	1
		Total Credits				**25**	**400**	**600**	**20**

AI&DS 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	1PC610AD	Computer Networks	3	0	0	3	40	60	3
2	1PC611AD	Machine Learning	3	0	0	3	40	60	3
3	1PC612AD	Automata Languages and Compiler Design	3	0	0	3	40	60	3
4	1PE6(06 to 10) AD	Professional Elective – II	3	0	0	3	40	60	3
5	OE	Open Elective – II	3	0	0	3	40	60	3
6	1HS652HS	Effective Technical Communication	2	0	0	2	40	60	2
Practical / Laboratory Courses									
7	1PC661AD	Machine Learning Lab	0	0	2	2	40	60	1
8	1PC662AD	Data Visualization Lab	0	0	2*2	4	40	60	2
9	1PW663AD	MiniProject	0	0	2	2	40	60	1
		Total Credits				**26**	**360**	**540**	**21**

Professional Elective - I

1	1PE501AD	Mobile Computing
2	1PE502AD	Data Mining
3	1PE503AD	Software requirements and Estimation
4	1PE504AD	Principles of Programming Languages
5	1PE505AD	Advanced Databases

Professional Elective - II

1	1PE606AD	Digital Forensics
2	1PE607AD	Information Retrieval Systems
3	1PE608AD	Software Project Management
4	1PE609AD	Web Technology
5	1PE610AD	Distributed Databases

Scheme of Instruction & Examination

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AI&DS 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	1PC713AD	Deep Learning	3	1	0	4	40	60	4
2	1PC714AD	Cryptography & Network Security	3	0	0	3	40	60	3
3	1PC715AD	Cloud Computing	3	0	0	3	40	60	3
4	1PE7(11 to 15) AD	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	1PC764AD	Deep Learning Lab	0	0	2	2	40	60	1
7	1PC765AD	Cryptography & Network Security Lab	0	0	2	2	40	60	1
8	1PW766AD	Project Work – I				4			2
9	1PW767AD	Summer Internship				-			2
		Total Credits				**24**	**360**	**540**	**22**

AI&DS 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	1HS802HS	Managerial Economics and Financial Accounting	3	0	0	3	40	60	3
2	1PE8(16 to 20) AD	Professional Elective – IV	3	0	0	3	40	60	3
3	1PE8(21 to 25) AD	Professional Elective – V	3	0	0	3	40	60	3
Practical / Laboratory Courses									
4	1PW868AD	Project Work – II				16	50	100	8
		Total Credits				**25**	**170**	**280**	**17**

Professional Elective - III

1	1PE711AD	Adhoc Sensor Networks
2	1PE712AD	Big Data Analytics
3	1PE713AD	Software Architecture and Design Patterns
4	1PE714AD	Scripting Languages
5	1PE715AD	Natural Language Processing

Professional Elective - IV

1	1PE816AD	Cyber security
2	1PE817AD	Web Mining
3	1PE818AD	Agile Methodologies
4	1PE819AD	Full Stack Development
5	1PE820AD	Soft Computing

Professional Elective –V

1	1PE821AD	Blockchain Technology
2	1PE822AD	Semantic Web and Social Networks
3	1PE823AD	Software Testing Methodologies
4	1PE824AD	Digital marketing and E Commerce
5	1PE825AD	Nature Inspired Computing

ARTIFICIAL INTELLIGENCE & DATA SCIENCE – CREDIT STRUCTURE

Category	Sem - I	Sem - II	Sem - III	Sem - IV	Sem - V	Sem - VI	Sem - VII	Sem - VIII	Total	OU	AICTE
HS		3		2	1	2		4	11	12	12
BS	9.5	9.5	4						23	25	25
ES	11	6	3		4				24	26	24
PC			13	17	8	12	12		62	58	48
PE					3	3	3	6	15	18	18
OE					3	3	3		9	9	18
PW			1	1	1	1	4	8	16	13	15
MC	ES	Yoga NSS/ Sports	EITK		IC					0	Non Credit
Total	20.5	18.5	21	20	20	21	22	17	**160**	**166**	**160**

LIST OF PROFESSIONAL ELECTIVES

S. No.	Networks/ Security	Data Science and Machine Intelligence	Software and Technology	Web Applications	Theory and Algorithms
1	Mobile Computing	Data Mining	Software requirements and Estimation	Principles of Programming Languages	Advanced Databases
2	Digital Forensics	Information Retrieval Systems	Software Project Management	Web Technology	Distributed Databases
3	Information Security	Big Data Analytics	Software Architecture and Design Pattern	Scripting Languages	Natural Language Processing
4	Cyber security	Applied AI	Agile Methodologies	Full Stack Development	Cloud Computing
5	Blockchain Technology	Semantic Web and Social Networks	Software Testing Methodologies	Digital marketing and E Commerce	Soft Computing

OPEN ELECTIVES OFFERED BY AI&DS to OTHER DEPARTMENTS

Open Elective - I

1	1OE501AD	Artificial Intelligence

Open Elective - II

1	1OE602AD	Deep Learning

Open Elective - III

1	1OE703AD	Machine Learning

Open Elective - IV

1	1OE804AD	Big Data Analytics

SYLLABUS

B. E. - Artificial Intelligence and Data Science

AI&DS 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	1BS305HS	Probability and Statistics	3	1	0	4	40	60	4
2	1PC301AD	Discrete Mathematics	3	0	0	3	40	60	3
3	1PC302AD	Database Management Systems	3	0	0	3	40	60	3
4	1PC303AD	Computer Organization and Microprocessor	3	0	0	3	40	60	3
5	1ES301EC	Switching Theory and Logic Design	3	0	0	3	40	60	3
6	1MC302HS	Essence of Indian Traditional Knowledge	2	0	0	2	40	60	0
Practical / Laboratory Courses									
7	1PC351AD	Database Management Systems Lab	0	0	2	2	40	60	1
8	1PC352AD	Python Programming Lab	0	0	2*2	4	40	60	2
9	1PC353AD	Computer Organization and Microprocessor Lab	0	0	2	2	40	60	1
10	1PW354AD	Skill Development Course- I	0	0	2	2	40	60	1
		Total Credits				**28**	**400**	**600**	**21**

Course Code	Course Title						Core / Elective
1BS305HS	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 the concepts of 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,parabolaand 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.

UNIT II

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

UNIT III

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

UNIT IV

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.

UNIT V

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, Narosa Publications (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
1PC301AD	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 to

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

The Foundations: Logic and Proofs: Propositional Logic, Applications of Propositional Logic, Propositional Equivalence, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Normal Forms, Introduction to Proofs, Proof Methods and Strategy.

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

Discrete Probability: An Introduction to Discrete Probability, Probability Theory, Bayes' Theorem, Expected Value and Variance

Advanced Counting Techniques: 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
1PC302AD	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
1PC303 AD	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
6. Apply knowledge and demonstrate interfaces with 8086 with outside world

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
1ES301EC	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.
   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

1. 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 LearningPrivate limited, Delhi India.
5. ZVI Kohavi. Switching and finite Automata theory, Tata McGraw-hill.

Course Code	Course Title						Core / Elective
1MC302HS	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 to

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

Course Code	Course Title						Core / Elective
1PC351AD	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
1PC352AD	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

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

List of Programs:

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/

Course Code	Course Title						Core / Elective
1PC353AD	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.

SKILL DEVELOPMENT COURSE-I

Semester III	**L**	**T**	**P**	**Credits**
Subject code – 1PW354 AD	**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
1PW354AD	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. - Artificial Intelligence and Data Science

AI&DS 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	1PC404AD	Operating Systems	3	0	0	3	40	60	3
2	1PC405AD	Statistical Analytics and Computing	3	0	0	3	40	60	3
3	1PC406AD	Foundations of Artificial Intelligence	3	1	0	4	40	60	4
4	1PC407AD	Software Engineering	3	0	0	3	40	60	3
5	1HS403HS	Human Values and Professional Ethics	2	0	0	2	40	60	2
Practical / Laboratory Courses									
6	1PC455AD	Operating Systems Lab	0	0	2	2	40	60	1
7	1PC456AD	Java Programming Lab	0	0	2*2	4	40	60	2
8	1PC457AD	Statistical Analytics and Computing using Python Lab	0	0	2	2	40	60	1
9	1PW458AD	Skill Development Course - II	0	0	2	2	40	60	1
		Total Credits				**25**	**360**	**540**	**20**

Course Code	Course Title						Core / Elective
1PC404AD	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.

UNIT II

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

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

Process Scheduling: Foundation and Scheduling objectives,Types of Schedulers, Scheduling Criteria, Scheduling algorithms, multiprocessor scheduling

UNIT III

Process Synchronization: Inter-process Communication: Critical Section, Race Conditions,Mutual Exclusion, Peterson's Solution, classical problems of synchronization: TheBounded buffer problem, Producer\Consumer Problem, reader's & writer problem,Dinning philosopher's problem.Semaphores, Event Counters, Monitors, Message Passing,

Deadlocks: Definition,Necessary and sufficient conditions for Deadlock,Methods for Handling:

Deadlocks: Deadlock prevention,Deadlock Avoidance: Banker's algorithm,Deadlock detection and Recovery.

UNIT IV

Memory Management: Basic concept,Logical and Physical address map,Memory allocation: Contiguous Memory allocation, fragmentation and Compaction; Paging: Principle of operation–Page allocation–Hardware support for paging, structure of Page table,Protection and 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

UNITV

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software:Goals of Interrupt handlers, Device drivers, Device independent I/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, IX Edition, Wiley Asia Student Edition, 2017.
2. William Stallings, Operating Systems: Internals and Design Principles, V Edition, Prentice Hall of India, 2016.
3. Andrew S. Tanenbaum (2007), Modern Operating Systems, II edition, Prentice Hall of India, India.

REFERENCE BOOKS

1. Maurice Bach, Design of the Unix Operating Systems, VIII 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
1PC405AD	STATISTICAL ANALYTICS AND COMPUTING						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 Statistical parameters for data analytics
2. To use Numpy for organizing and analyzing data
3. To use pandas for summarizing and analysis of data
4. To use of statistical methods for cleaning and preparation of data
5. To performs aggregation of data and understand analysis of time series data.

COURSE OUTCOMES:

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

1. Understand Statistical parameters for data analytics
2. Use Numpy for organizing and analyzing data
3. Use pandas for summarizing and analysis of data
4. Use of statistical methods for cleaning and preparation of data
5. Performs aggregation of data and understands analysis of time series data

UNIT I

Python Language Basics, IPython, and Jupyter Notebooks: The Python Interpreter, IPython Basics, Python Language Basics

Built-in Data Structures, Functions, and Files: Data Structures and Sequences, Functions, Files and the Operating System

UNIT II

NumPyBasics: Arrays and Vectorized Computation: The NumPyndarray: A Multidimensional Array Object, Universal Functions, Array-Oriented Programming with Arrays, File Input and Output with Arrays, Linear Algebra, Pseudorandom Number Generation, Example: Random Walks

UNIT III

PANDAS: Introduction to pandas Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics, Reading and Writing Data in Text Format, Binary Data Formats, Interacting with Web APIs, Interacting with Databases

UNIT IV

Data Cleaning and Preparation: Handling Missing Data, Data Transformation, String Manipulation

Data Wrangling: Join, Combine, and Reshape: Hierarchical Indexing, Combining and Merging Datasets, Reshaping and Pivoting

UNIT V

Data Aggregation and Group Operations: GroupBy Mechanics, Data Aggregation, Apply: General split-apply-combine, Pivot Tables and Cross-Tabulation

Time Series: Date and Time Data Types and Tools, Time Series Basics, Date Ranges, Frequencies, and Shifting, Periods and Period Arithmetic, Resampling and Frequency Conversion, Moving Window Functions

TEXTBOOKS

1. Wes McKinney, Python for Data Analysis- Data Wrangling with Pandas, Numpy, And Ipython, O-Reilly, 2018
2. Fabio Nelli, Python Data Analytics, Apress, 2015

REFERENCE BOOKS

1. Peters Morgan, Data Analysis From Scratch With Python: Beginner Guide using Python, Pandas, NumPy, Scikit-Learn, IPython, TensorFlow and Matplotlib, AI Sciences, 2018.
2. Andrew Park, Python for Data Analysis: A Step-By-Step Guide to Master the Basics of Data Science and Analysis in Python Using Pandas, NumpyandIpython, Independently Published, 2020.

Course Code	Course Title						Core / Elective
1PC406AD	FOUNDATIONS OF 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

1. To introduce the AI techniques to solve problems and search strategies to find optimal solution paths from start to goal state.
2. To introduces different knowledge representation methods in AI Programs.
3. To introduce different design techniques for Game Playing Programs.
4. To introduce the AI Agents their design, planning and learning techniques.
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 and identify a range of symbolic and non-symbolic AI techniques.
2. Demonstrate an understanding of various searching algorithms such as adversarial search and game-playing commonly used in artificial intelligence software.
3. Use different knowledge representation techniques used in AI Applications.
4. Demonstrate an understanding of agent based AI architectures, Planning and logic based agents.
5. Exploring Expert systems.

UNITI

Introduction: Artificial Intelligence and its applications, Artificial Intelligence Techniques

Problem solving techniques: State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search, AO* search, Constraint satisfaction problem, Agenda Driven Search, Mean-end analysis, Min- Max Search, Alpha-Beta Pruning, Iterative Deepening.

UNITII

Knowledge representation: Mapping between facts and representations, Approaches to knowledge representation, procedural vs declarative knowledge, Forward vs. Backward reasoning, Matching, conflict resolution, Weak and Strong filler structures.

UNITIII

Non Monotonic and Statistical Reasoning: on monotonic Logic, Default Logic, Circumscription, Bayes Theorem, Bayesian Network, Dempster Shafer Theory, Fuzzy sets, Fuzzy Logic, Defuzzification.

UNITIV

Planning and Learning Agents: Intelligent Agents, Nature and structure of Agents, Learning Agents, Introduction to different Forms of Learning, The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning.

UNITV

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

TEXTBOOKS

1. AI: A Modern Approach Stuart J. Russel, Peter Norvig Pearson Education Latest Edition, 2012.
2. Artificial Intelligence Elaine Rich, Knight McGraw Hill III Edition, 2010.
3. Artificial Intelligence, Saroj Kaushik Cengage Learning, First Edition, 2011.

REFERENCES

1. Artificial Intelligence, Partick Henry, Winston, Addison Wesley, Latest Edition, 2012.
2. Artificial Intelligence, George Luger, Pearson Education, Latest Edition, 2010.

Course Code	Course Title						Core / Elective
1PC407AD	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.

Software Development Process Models: Prescriptive Models,Waterfall Model,Incremental Process Models,Evolutionary Process Models, Specialized Process Models, The UnifiedModels, PersonalandTeam Process Models, Process Technology,Product and Process.

UNIT II

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

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

UNIT III

Building the Analysis Model: Data Modeling Concepts, Object-Oriented Analysis,Scenario-based Modeling,Flow-oriented Modeling,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

Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, 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.

Current trends in Software Engineering 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
1HS403HS	HUMAN VALUES AND 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
1PC455AD	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-writer's 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
1PC456AD	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 2: Subject 3: …. SGPA : CGPA :	Subject 1: Subject 2: Subject 3: …. SGPA : CGPA :	Subject 1: Subject 2: Subject 3: …. SGPA : CGPA :

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

Course Code	Course Title						Core / Elective
1PC457AD	STATISTICAL ANALYTICS AND COMPUTING USING PYTHON 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. Install Numpy and Pandas
2. Work with 1D and 2D array in Numpy
3. Explore multi-dimensional arrays in Numpy
4. Perform statistical analysis using Numpy
5. Perform statistical analysis using Pandas

COURSE OUTCOMES:

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

1. Install Numpy and Pandas
2. Work with 1D and 2D array in Numpy and process data in arrays
3. Explore multi-dimensional arrays in Numpy and perform conversions
4. Perform statistical analysis using Numpy by calculating measures od central tendency, deviation, distances and correlation
5. Perform statistical analysis using Pandas

List of Programs

1. Installing Numpy
2. Working with arrays
    a. Create a 1D array
    b. Create a boolean array
    c. Extract items that satisfy a given condition from 1D array
    d. Replace items that satisfy a condition with another value in numpy array
    e. Replace items that satisfy a condition without affecting the original array
    f. Reshape an array
    g. Extract all numbers between a given range from a numpy array
3. Multiple arrays
    a. Stack two arrays vertically
    b. Stack two arrays horizontally
    c. Get the common items between two python numpy arrays
    d. Remove from one array those items that exist in another
    e. Get the positions where elements of two arrays match
4. Multi-dimensional arrays
    a. Convert an array of arrays into a flat 1d array
    b. Swap two columns in a 2d numpy array

5. Statistical analysis
    a. Compute the mean, median, standard deviation of a numpy array
    b. Find the percentile scores of a numpy array
    c. compute the euclidean distance between two arrays
    d. Find the correlation between two columns of a numpy array
    e. Probabilistic sampling in numpy
    f. compute the moving average of a numpy array
6. Data Cleaning
    a. Find the position of missing values in numpy array
    b. Drop rows that contain a missing value from a numpy array
    c. Replace all missing values with 0 in a numpy array
    d. Drop all missing values from a numpy array
7. Data Transformation
    a. Normalize an array so the values range exactly between 0 and 1
    b. Compute the min-by-max for each row for a numpy array 2d
8. Pandas Basics
    a. Installing Pandas
    b. Import pandas and check the version
    c. Create a series from a list, numpy array and dict
    d. Convert the index of a series into a column of a dataframe
    e. Combine many series to form a dataframe
9. Statistical analysis in pandas
    a. Get the minimum, 25th percentile, median, 75th, and max of a numeric series
    b. Get frequency counts of unique items of a series
    c. Bin a numeric series to 10 groups of equal size
    d. Compute the euclidean distance between two series
10. Data Preparation in pandas
    a. Normalize all columns in a dataframe
    b. Compute the correlation of each row with the suceeding row
    c. Compute the autocorrelations of a numeric series

SKILL DEVELOPMENT COURSE-II

Semester IV	**L**	**T**	**P**	**Credits**
Subject code – 1PW458AD	**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
1PW458AD	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. – Artificial Intelligence and Data Science

AI&DS 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	1PC508AD	Design and Analysis of Algorithms	3	1	0	4	40	60	4
2	1PC509AD	Data Science	3	0	0	3	40	60	3
3	1ES501CS	Digital Image Processing	3	0	0	3	40	60	3
4	1PE5(01 to 05) AD	Professional Elective – I	3	0	0	3	40	60	3
5	OE	Open Elective – I	3	0	0	3	40	60	3
6	1MC503HS	Indian Constitution	3	0	0	3	40	60	0
Practical / Laboratory Courses									
7	1PC559AD	Data Science Lab	0	0	2	2	40	60	1
8	1ES551CS	Digital Image Processing Lab	0	0	2	2	40	60	1
9	1HS553HS	Soft Skills Lab-I	0	0	2	2	40	60	1
10	1PW560AD	Skill DevelopmentCourse - III	0	0	2	2	40	60	1
		Total Credits				**25**	**400**	**600**	**20**

Professional Elective – I

1	1PE501AD	Mobile Computing
2	1PE502AD	Data Mining
3	1PE503AD	Software Requirements and Estimation
4	1PE504AD	Principles of Programming Languages
5	1PE505AD	Advanced Databases

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
1PC508AD	DESIGN AND ANALYSIS OF ALGORITHMS						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. 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

UNITV

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, IIEdition,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, I Edition, John Wiley & Sons,2002
2. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, II Edition, Pearson education.

Course Code	Course Title						Core / Elective
1PC509AD	DATA SCIENCE						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. Learn fundamental knowledge on basics of data science and R programming
2. Learn basics of R Programming environment: R language, R- studio and R packages
3. Understand various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting
4. Learn fundamentals of how to obtain, store, explore, and model data efficiently.
5. Understand the concepts of classification and clustering.

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

1. Recognize the different levels of Data Science concepts for visualization of data.
2. Demonstrate the data visualization and statistical techniques, for describing data structure property.
3. Analyze the basics of probability and statistics models for data exploration
4. Make use of Hypothesis testing for statistical analytics for destroying target based on the mission requirements.
5. Demonstrate numerous open source data science tools to solve real-world problems through industrial case studies

UNIT I

Data Science: Introduction to data science, Data Science process, Need for Data Science, Linear Algebra for data science, Linear equations, Distance, Eigen values, Eigenvectors

UNIT II

Descriptive statistics, data preparation. Exploratory Data Analysis data summarization, data distribution, measuring asymmetry. Sample and estimated mean, variance and standard score. Statistical Inference frequency approach, variability of estimates, hypothesis testing using confidence intervals, using p-values.

UNIT III

Introduction to R Programming, getting started with R: Installation of R software and using the interface, Variables and data types, R Objects, Vectors and lists, Arrays, Classes, R-Programming Structures, Operations: Arithmetic, Logical and Matrix operations, Data frames, functions, Control structures, Debugging and Simulation in R

UNIT–IV

Predictive Modeling: Linear Regression, Simple Linear Regression model building, Multiple Linear Regression, Logistic regression, Simulation in R.

UNIT–V

Classification: performance measures, Logistic regression implementation in R, K-Nearest neighbours (KNN), K-Nearest neighbours implementation in R, Clustering: K-Means Algorithm, K Means implementation in R. Time Series Analysis using R, Social Network Analysis, Reading data from relational databases- MySQL, Reading data from NoSQL databases- MongoDB

TEXT BOOKS

1. Practical Data Science with R, Nina Zumel, II Edition, Manning Publications, 2014.
2. Practical Statistics for Data Scientists, Peter Bruce and Andrew Bruce, II Edition, O'Reilly, 2017.
3. R for Data Science, Hadley Wickham and Garrett Grolemund,II Edition, O'Reilly, 2017

REFERENCE BOOKS

1. R Programming for Data science, Roger D Peng, Lean Publishing, 2016.
2. Introduction to Data Science, Rafael A Irizarry, Lean Publishing,2016.
3. R Data Analysis cookbook, VishwaVishwanathan and ShanthiVishwanathan 2015

Course Code	Course Title						Core / Elective
1ES501CS	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

1. To provide a 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 on an image

COURSE OUTCOMES:

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

1. Explore the fundamental relations between pixels and utility of 2-D transforms in imageprocesser.
2. Implement the various Morphological operations on an image
3. Describe different techniques employed for the enhancement of images.
4. Understand different causes for image degradation and overview of image restoration techniques.
5. Understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.

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,SpatialDomainHigh-PassFiltering.
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

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
1PE501AD	MOBILE COMPUTING						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 make the student understand the concept of mobile computing paradigm, its novel applications and limitations.
2. To understand the typical mobile networking infrastructure through a popular GSM protocol
3. To understand the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer
4. To understand the database issues in mobile environments & data delivery models.
5. To understand the ad hoc networks and related concepts.

COURSE OUTCOMES:

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

1. Develop new mobile application.
2. Understand new technical issue related to this new paradigm and come up with a solution(s).
3. Develop new adhoc network applications and/or algorithms/ protocols.
4. Understand & develop any existing or new protocol related to mobile environment

UNIT I

Introduction: Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices.

GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS, CSHSD, DECT.

UNIT II

(Wireless) Medium Access Control (MAC): Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN (IEEE 802.11), 5G

Mobile Network Layer: IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP.

UNIT III

Mobile Transport Layer: Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks.

Database Issues: Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process &QoS Issues.

UNIT IV

Data Dissemination and Synchronization: Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software, and Protocols

UNIT V

Mobile Ad hoc Networks (MANETs): Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc., Mobile Agents, Service Discovery.

TEXTBOOKS

1. Mobile Communications, Jochen Schiller,II Edition, Pearson Education, 2008.
2. FundamentalsofMobileComputing,PrasantKumarPattnaik,Rajib Mall, PHI Learning 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, Manvi et 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
1PE502AD	DATA MINING						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. 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.

Data warehouse implementation: 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

UNIT II

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

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. Correlation Analysis– Constraint based Association mining.

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. Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor.

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

REFERENCE BOOKS

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

Course Code	Course Title						Core / Elective
1PE503AD	SOFTWARE REQUIREMENTS AND ESTIMATION						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

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

UNIT I

Software Requirements: What and Why: Essential Software requirement, Good practices for requirements engineering, Improving requirements processes,Software requirements and risk management.

Software Requirements Engineering: Requirements elicitation, requirements analysis documentation,review,elicitation techniques, analysis models,Software quality attributes,risk reduction through prototyping,setting requirements priorities,verifying requirements quality.

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,Dataflow 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 and Cost Estimation: What is Productivity? Estimation Factors, Approaches to Effort and Schedule Estimation, COCOMOII, Putnam Estimation Model, Algorithmic models,Cost Estimation

UNIT V

Tools for Requirements Management and Estimation

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 estimation tools, IFPUG, USC's COCOMO II, 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, 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
1PE504AD	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

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, VIII Edition, Pearson Education, 2008.
2. Programming Languages Design Concepts, D. A. Watt, Wiley Dreamtech, 2007.

REFERENCE BOOKS

1. Programming languages, A. B. Tucker, R E Noonan, II Edition, McGraw-Hill Education, 2001.
2. Programming Languages, K C Louden, II Edition, Thomson, 2003.
3. LISP,Patrick Henry Winston, Bertbold Klaus Paul Horn, Pearson Education, 2000.
4. Programming in Prolog: Using the ISO Standard, C.S. Mellish, William F. Clocksin,V Edition, Springer, 2003.

Course Code	Course Title						Core / Elective
1PE505AD	ADVANCED DATABASES						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 understand different data models that can be used for these databases.
2.To get familiarized with transaction management of the database
3.To develop in-depth knowledge about web and intelligent database.
4.To provide an introductory concept about the way in which data can be stored in geographical information systems etc

COURSE OUTCOMES:

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

1.Understand the concept of Distributed DBMS and concurrency control.
2.Acquire the knowledge on Object Oriented Databases.
3.Design web application by using markup language.
4.Understand advanced applications and active databases.
5.Understand mobile database and multimedia databases.

UNIT I

Distributed DBMS Concepts and Design – Introduction –Functions and Architecture of DDBMS – Distributed Relational Database Design – Transparency in DDBMS – Distributed Transaction Management – Concurrency control – Deadlock Management – Database recovery – The X/Open Distributed Transaction Processing Model – Replication servers – Distributed Query Optimization - Distribution and Replication in Oracle.

UNIT II

Object Oriented Databases – Introduction – Weakness of RDBMS – Object Oriented Concepts Storing Objects in Relational Databases – Next Generation Database Systems – Object Oriented Data models – OODBMS Perspectives – Persistence – Issues in OODBMS – Object Oriented Database Management System Manifesto – Advantages and Disadvantages of OODBMS – Object Oriented Database Design – OODBMS Standards and Systems – Object Management Group – Object Database Standard ODMG – Object Relational DBMS –Postgres - Comparison of ORDBMS and OODBMS.

UNIT III

Web Technology And DBMS – Introduction – The Web – The Web as a Database Application Platform – Scripting languages – Common Gateway Interface – HTTP Cookies – Extending the Web Server – Java – Microsoft's Web Solution Platform – Oracle Internet Platform – Semi structured Data and XML – XML Related Technologies – XML Query Languages

UNIT IV

Enhanced Data Models For Advanced Applications – Active Database Concepts And Triggers – Temporal Database Concepts – Deductive databases – Knowledge Databases

UNIT V

Mobile Database – Geographic Information Systems – Genome Data Management – Multimedia Database – Parallel Database – Spatial Databases - Database administration – Data Warehousing and Data Mining

TEXTBOOKS

1. Database Systems - A Practical Approach to Design,Implementation, and Management, Thomas M. Connolly, Carolyn E. Begg, III Edition, Pearson Education, 2003
2. Patrick Valduriez M. TamerOzsu, Principles of Distributed Database Systems, II Edition, Prentice Hall, 1999.

REFERENCE BOOKS

1. Fundamentals of Database Systems, RamezElmasri&ShamkantB.Navathe, IVEdition, Pearson Education , 2004.
2. Principles of Distributed Database Systems, M.TamerOzsu, Patrick Ualduriel, II Edition, PearsonEducation, 2003.

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 and identify a range of symbolic and non-symbolic AI techniques.
2. Demonstrate an understanding of varioussearching algorithms such as adversarial search and game-playing commonly used in artificial intelligence software.
3. Use different knowledge representation techniques used in AI Applications.
4. Demonstrate an understanding of agent based AI architectures, Planning and logic based agents.
5. Exploring Expert systems options.

UNIT I

Introduction: Artificial Intelligence and its applications, Artificial Intelligence Techniques
Problem solving techniques: State space search, control strategies, heuristic search, problem characteristics, production system characteristics.,Generate and test,Hill climbing,best first search,A* search,AO* search,Constraint satisfaction problem,Agenda Driven Search,Mean-end analysis,Min-Max Search, Alpha-Beta Pruning,Iterative Deepening.

UNIT II

Knowledge representation: Mapping between facts and representations, Approaches to knowledge representation, procedural vs declarative knowledge, Forward vs.Backward reasoning,Matching,conflict resolution,Weak and Strong filler structures.

UNIT III

Non Monotonic and Statistical Reasoning: onmonotonic Logic, Default Logic,Circumscription, Bayes Theorem, Bayesian Network, Dempster Shafer Theory, Fuzzy sets,FuzzyLogic,Defuzzification.

UNIT IV

Planning and Learning Agents: Intelligent Agents, Nature and structure of Agents,Learning Agents, Introduction to different Forms of Learning, The Planning problem, planning with state space search,partial order planning,planning graphs,planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning,Continuous and Multi Agent planning.

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. ArtificialIntelligence,ElaineRich,Knight, McGrawHillThirdEdition, 2010
3. ArtificialIntelligence,SarojKaushik,CengageLearning,FirstEdition, 2011

REFERENCES

1. ArtificialIntelligence,ParticKHenryWinston,AddisonWesleyLatestEdition, 2012.
2. ArtificialIntelligence,GeorgeLuger,PearsonEducationLatestEdition, 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,Restorationofessentialservices,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 communication and public awareness in India and the world

TEXTBOOKS

1. R. Subramanian, Disaster Management, Vikas Publishing House, 2018.
2. .M.M. Sulphey, Disaster Management, PHI Learning, 2016.

REFERENCEBOOKS

1. S. C. Sharma, Disaster Management: Concepts, Approaches and Techniques, Khanna Book Publishing House, 2017.
2. G.K. Ghosh, Disaster Management: Theory and Practice, APH Publishing Corporation, 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, III Edition, 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

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, Renewable EnergySystems,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	BASICS OF ELECTRONIC COMMUNICATION						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.

UNIT I

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.

UNIT II

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

UNIT III

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

UNIT IV

Telecommunication Systems: Telephones, Telephone system, Optical Communications: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers,Wavelength Division Multiplexing.

UNIT V

Wireless Communications: Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, OFDM.Current Wireless Technologies: Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication,UWB, Wireless mesh networks,Vehicular adhoc 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-UPENTREPRENEURSHIP						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 the completion of course the students will be able to:

1. Understand Entrepreneurship and Economic growth, Small and Large Scale Industries, Types and forms of enterprises.
2. Identify the characteristics of entrepreneurs, Emergence of first generation entrepreneurs, Conception and evaluation of ideas and their sources.
3. Practice the principles of project formulation, Analysis of market demand,Financial and profitability analysis and Technical analysis.
4. Understand the concept of Intellectual Property Rights and Patents
5. Comprehend the aspects of Start-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

Indian Industrial Environment: Competence, Opportunities and Challenges, Emergence of First generation entrepreneurs, women entrepreneurs. Conception and evaluation of ideas and their sources. Types of enterprises. Collaborative interaction for Technology development. Corporate Social Responsibility

UNIT III

Project formulation: Introduction, Elements of Business Plan and its salient features, Analysis of market demand, Financial and profitability analysis and Technical analysis.

UNIT IV

Intellectual Property Rights: Meaning, Nature, Classification and protection of Intellectual Property,the main forms of Intellectual Property, Concept of Patent, Patent document,Invention protection, Granting of patent, Rights of a patent,Licensing, Transfer of technology.

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. Vasant Desai,"Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House,
2. Prasanna Chandra,"Project-Planning, Analysis, Selection, Implementation and Review",TataMcGraw-Hill Publishing Company Ltd.
3. Ajit Parulekar and Sarita D'Souza, Indian Patents Law–Legal & Business Implications, Macmillan India Ltd.

REFERENCE BOOKS

1. Stephen R.Covey and A.Roger Merrill,"First Things First",Simonand Schuster Publication.
2. G.S.Sudha,"Organizational Behaviour".
3. Robert D.Hisrich, Michael P.Peters, "Entrepreneurship", Tata MeGraw Hill Publishing Company Ltd.,V Edition.
4. G.B.Reddy,Intellectual Property Rights and the Law V Edition .GogiaLawAgency.

Course Code	Course Title	Core / Elective

1MC503HS	INDIAN CONSTITUTION						MC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	40	60	0

COURSE OBJECTIVES:

The objective of this course is to make the student

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 I

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,

UNIT III

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
1PC559AD	DATA SCIENCE 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. Understand the R Programming Language.
2. Understand and apply the data analytics technique for visualization
3. Understand pull data from different sources (small dataset and large datasets), clean and manipulate data
4. Understand the classification and regression model.
5. Exposure on solving of data science real world problems.

COURSE OUTCOMES:

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

1. Understand the concept of Setup R Programming Environment.
2. Develop programming logic using R-data types, R-Data Structures and R – Packages.
3. Analyze data sets using R – programming capabilities.
4. Apply various classification and regression models.
5. Apply various clustering techniques on different data sets

List of Programs

1. R AS CALCULATOR APPLICATION
    a. Using with and without R objects on console
    b. Using mathematical functions on console
    c. Write an R script, to create R objects for calculator application and save in a specified location in disk.
2. DESCRIPTIVE STATISTICS IN R
    a. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& cars datasets.
    b. Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset
3. READING AND WRITING DIFFERENT TYPES OF DATASETS
    a. Reading different types of data sets (.txt, .csv) from Web and disk and writing in file in specific disk location.
    b. Reading Excel data sheet in R.
    c. Reading XML dataset in R
4. VISUALIZATIONS
    a. Find the data distributions using box and scatter plot.
    b. Find the outliers using plot.
    c. Plot the histogram, bar chart and pie chart on sample data
5. CORRELATION AND COVARIANCE
    a. Find the correlation matrix.
    b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.
    c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data
6. REGRESSION MODEL

    Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. Require (foreign), require (MASS)

7. MULTIPLE REGRESSION MODEL
   Apply multiple regressions, if data have a continuous Independent variable. Apply on above dataset
8. REGRESSION MODEL FOR PREDICTION
   Apply regression Model techniques to predict the data on above dataset.
9. CLASSIFICATION MODEL
   a. Install relevant package for classification.
   b. Choose classifier for classification problem.
   c. Evaluate the performance of classifier.
10. CLUSTERING MODEL
   a. Clustering algorithms for unsupervised classification.
   b. Plot the cluster data using R visualizations.
11. Write R program to find all elements of a given list that are not in another given list.
12. Write a R program to show plot using the mosaicplot() function.
13. Write a R program to show plot using stripchart() and QQ Plots

Course Code	Course Title						Core / Elective
1ES551CS	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
1HS553HS	SOFT SKILLSLAB-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.

Course Code	Course Title						Core / Elective
1PW560AD	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

B. E. – Artificial Intelligence and Data Science

AI&DS 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	1PC610AD	Computer Networks	3	0	0	3	40	60	3
2	1PC611AD	Machine Learning	3	0	0	3	40	60	3
3	1PC612AD	Automata Languages and Compiler Design	3	0	0	3	40	60	3
4	1PE6(06 to 10) AD	Professional Elective – II	3	0	0	3	40	60	3
5	OE	Open Elective – II	3	0	0	3	40	60	3
6	1HS652HS	Effective Technical Communication	2	0	0	2	40	60	2
Practical / Laboratory Courses									
7	1PC661AD	Machine Learning Lab	0	0	2	2	40	60	1
8	1PC662AD	Data Visualization Lab	0	0	2*2	4	40	60	2
9	1PW663AD	MiniProject	0	0	2	2	40	60	1
		Total Credits				**26**	**360**	**540**	**21**

Professional Elective – II

1	1PE606AD	Digital Forensics
2	1PE607AD	Information Retrieval Systems
3	1PE608AD	Software Project Management
4	1PE609AD	Web Technology
5	1PE610AD	Distributed Databases

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
1PC610AD	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

The Network Layer in Internet: IPV4, IPV6, IP Addressing, NAT.

Internet Networking: Tunnelling, Fragmentation, Congestion Control(Leaky Bucket and Token Bucket Algorithm), and Internet control protocols: ARP, RARP and DHCP

UNIT IV

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

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. Computer Networks, Andrew S Tanenbaum, V Edition, Pearson Education, 2011.
2. Data Communication and Networking,Behrouz A. Forouzan, IV Edition, TMH, 2008.
3. Data and Computer Communications, William Stallings, VIII Edition, PHI, 2004.

REFERENCE BOOKS

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

Course Code	Course Title						Core / Elective
1PC611AD	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. Extract features that can be used for a particular machine learning approach in various applications.
2. Compare and contrast pros and cons of various machine learning techniques and to get an insight when to apply particular machine learning approach.
3. Understand different machine learning types along with algorithms.
4. Understand how to apply machine learning in various applications.
5. Apply ensemble techniques for improvement of classifiers

UNIT I

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

Types of Machine Learning Algorithms: Parametric and Non-parametric Machine Learning Algorithms, Supervised, Unsupervised, Semi-Supervised and Reinforced Learning.

UNIT II

Supervised Algorithms:

Regression:Linear Regression, Logistic Regression, 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

Feature Selection and Dimensionality Reduction

Ensemble Algorithms: Bagging, Random Forest, 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, Machine Learning, McGraw-HillScience/Engineering/Math(1997).
2. Stephen Marsland,Machine Learning: An Algorithmic Perspective,Second Edition Chapman &Hall/CRC Press

REFERENCE BOOKS

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012

Course Code	Course Title						Core / Elective
1PC612AD	AUTOMATA LANGUAGES AND COMPILER DESIGN						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 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

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 and rightmost derivation of strings and Sentential forms, Ambiguity, left recursion and left factoring in context free grammars, Minimization of context free grammars, Normal forms for context free grammars, Chomsky normal form

Pushdown Automata: Introduction to Pushdown automata, Acceptance of context free languages, Acceptance by final state and acceptance by empty state and its equivalence, Equivalence of context free 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, JeffreyD.Ullman, III Edition,Pearson Education, 2011.
2. Compilers-Principles Techniques and Tool, Alfred Aho, Monica S Lam, Ravi Sethi, Jeffrey D.Ullman,II Edition,Pearson Education India,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
1PE606AD	DIGITAL FORENSICS						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 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
1PE607AD	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

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 formulates SQL like queries for unstructured data
4. 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),

REFERENCE BOOKS

1. Information Storage and Retrieval Systems, Gerald J Kowalski, Mark T Maybury, Springer, 2000
2. Mining the Web: Discovering Knowledge from Hypertext Data, SoumenChakrabarti, Morgan-Kaufmann Publishers, 2002
3. An Introduction to Information Retrieval, Christopher D. Manning, PrabhakarRaghavan, HinrichSchütze, Cambridge University Press, Cambridge, England, 2009

Course Code	Course Title						Core / Elective
1PE608AD	SOFTWARE PROJECT MANAGEMENT						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. 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 Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and 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 and scheduling –

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 Carlo simulation – 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
1PE609AD	WEB TECHNOLOGY						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 understand the technologies used in Web Programming.
2. To know the importance of object-oriented aspects of Scripting.
3. To understand creating database connectivity using JDBC.
4. To learn the concepts of web-based application using sockets.

COURSE OUTCOMES:

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

1.Apply the concepts of PHP in creating web pages and connecting to database (My sql)

2. Apply the concepts of XML for structuring the web pages.

3. Make use of Servlets to create dynamic web pages in client-server architecture.

4. Make use of JSP to develop interactive web pages.

5. Apply the techniques of Java script in client side scripting

UNITI

HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets.
Client-side Scripting: Introduction to Javascript, Javascript language – declaring variables, scope of variables, functions. Event handlers (onclick, onsubmit etc.), Document Object Model, Form validation.

UNITII

XML: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XMLSchemes, Document Object Model, XHTML Parsing XML Data – DOM and SAX Parsers in java.

UNIT III

Introduction to PHP: Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, Reading data from web form controls like text boxes, radio buttons, lists etc.,
Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text andbinary files, listing directories.

UNIT IV

Introduction to Servlets: Common Gateway Interface (CGt), Life cycle of a Servlet, deploying a servlet, TheServlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request &Responses, Using Cookies and Sessions, connecting to a database using JDBC.

UNIT V

Introduction to JSP: The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions,Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session for session tracking,connecting to database in JSP

TEXT BOOKS

1. Internet and World Wide Web: How to Program,Harvey Deitel, Abbey Deitel, V Edition.
2. Java - The Complete Reference, Herbert Schildt, VII Edition. Tata McGraw- Hill Edition.
3. XML Unleashed,Michael Morrison,Tech media SAMS.

REFERENCE BOOKS

1. Javascript - A Beginners Guide, John Pollock,III Edition – Tata McGraw-Hill Edition.
2. Gateway to Java Programmer Sun Certification, KeyurShah,Tata McGraw Hill, 2002.

Course Code	Course Title						Core / Elective
1PE610AD	DISTRIBUTED DATABASES						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 data base system and need of distributed database technology.
2. To acquire the knowledge on Database design and query processing.
3. To learn Distributed Concurrency control mechanism and algorithms.
4. To understand the concept of Distributed Database reliability and Distributed Object Database Management

COURSE OUTCOMES:

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

1. Able to identify various design issues and architectural models.
2. Able to analyse the query to process the data.
3. Able to understand the concurrency control algorithms.
4. Able to understand the reliability protocols of distributed database.
5. Able to improve application programmer productivity

UNIT I

Distributed Data Processing, Distributed Database Systems, Promises of DDBSs, Distributed Database Design, Distributed Directory Management, Distributed Query Processing, Distributed Concurrency Control, Distributed Deadlock Management, ANSI/SPARC Architecture, A Generic Centralized DBMS Architecture, Architectural Models for Distributed DBMSs

UNIT II

Distributed Database Design, Distribution Design Issues, Fragmentation, Allocation, Data Directory, Data and Access Control, Query Processing, Objectives of Query Processing, Characterization of Query Processors, Layers of Query Processing, Query Decomposition.

UNIT III

Transaction Management, Properties, Types of Transactions, Distributed Concurrency Control, Taxonomy of Concurrency Control Mechanisms, Locking-Based Concurrency Control Algorithms, Timestamp-Based Concurrency Control Algorithms, Optimistic Concurrency Control Algorithms

UNIT IV

Distributed DBMS Reliability, Reliability Concepts and Measures, Failures in Distributed DBMS, Local Reliability Protocols, Distributed Reliability Protocols, Network Partitioning.

UNIT V

Distributed Object Database Management, Fundamental Object Concepts and Object Models, Object Distribution Design, Architectural Issues, Object Management, Object Query Processing.

TEXT BOOKS

1. Principles of Distributed Database Systems, M. Tamer OZSU and Patrick Valduriez, SpringerIII Edition. 2010.
2. Distributed Databases, Stefano Ceri and Giuseppe Pelagatti, McGraw Hill.

REFERENCE BOOKS

1. Database system concepts', Abraham Silberschatz, Henry Korth, S, Sudarshan, VIEdition ,McGraw Hill International

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

Fundamentals about Deep Learning. Perception Learning Algorithms. Probabilistic modelling. Early Neural 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

About Neural Network. Building Blocks of Neural Network .Optimizers. Activation Functions. Loss Functions. Data Pre-processing for neural networks, Feature Engineering. Overfitting and Underfitting. Hyperparameters.

UNIT III

About CNN. Linear Time Invariant. Image Processing Filtering. Building a convolutional neural network. Input Layers, Convolution Layers. Pooling Layers. Dense Layers. Backpropagation Through the Convolutional Layer. Filters and Feature Maps.Back propagation Through the Pooling Layers. Dropout Layers and Regularization. Batch Normalization. Various Activation Functions.Various Optimizers. LeNet, AlexNet, VGG16, ResNet. Transfer Learning with Image Data. Transfer Learning 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. Partof Speech(PoS)Global Cooccurrence Statistics–based Word Vectors. Transfer Learning. Word2Vec. Global Vectors for Word Representation GloVe.Backpropagation Through Time.Bidirectional RNNs (BRNN). Long ShortTerm Memory (LSTM). Bi-directional LSTM. Sequence-to-Sequence Models (Seq2Seq).GatedrecurrentunitGRU.

UNIT V

About Deep Reinforcement Learning. Q-Learning. DeepQ-Network (DQN). Policy Gradient Methods.Actor-Critic Algorithm. About Autoencoding .Convolutional Auto Encoding. Variational

TEXTBOOKS

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

REFERENCE BOOKS

1. Deep Learning with Python, François Chollet, Manning Shelter Island, 2017
2. Pro Deep Learning with Tensor Flow, Santanu Pattanayak, 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. Explaintheenergyefficiency terms 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.

Software Development Process Models: Prescriptive Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Models, Personal and Team Process Models, Process Technology,Product and Process.

UNIT II

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

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

UNIT III

Building the Analysis Model: Data Modeling Concepts,Object-Oriented Analysis,Scenario-based Modeling,Flow-oriented Modeling,Class-based Modeling.

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

Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, 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. 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
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	3DPRINTINGTECHNOLOGIES						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.**Solidground curing**(**SGC**):Modelsandspecifications,Process,workingprinciple,Applications,AdvantagesandDisadvantages.

UNITIII

Solid-basedSystems:LaminatedObjectManufacturing(LOM): Modelsandspecifications,Process,workingprinciple,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
1HS652HS	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
1PC661AD	MACHINE LEARNING 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. Demonstrationofdifferentclassifiersondifferentdata.
2. Demonstrateensemblingofclassifiersforsolvingrealworldproblems.
3. Makeuseofrealworlddatatoimplement machinelearningmodels

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/unsupervisedlearningalgorithm using Weka tool

Course Code	Course Title						Core / Elective
1PC662AD	DATA VISUALIZATION LAB						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2*2	40	60	2

COURSE OBJECTIVES:

The objective of this course is to make the student to

1. Learn the basics of data visualization and Tableau Desktop.
2. ToCreate common visualizations such as bar charts, line charts, and pie charts.
3. Create simple calculations in Tableau.
4. Add interactivity to your visualizations with text and visual tooltips.
5. Create more advanced chart types such as maps, scatter plots, and treemaps

COURSE OUTCOMES:

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

1. Understand the basics of data visualization and the best practices for creating effective visualizations.
2. Be able to connect to data sources and create basic visualizations in Tableau Desktop.
3. Be able to create more advanced visualizations and dashboards using table calculations, filters, and actions.
4. Be able to tell data stories using Tableau by creating interactive visualizations and dashboards that communicate insights to an audience.
5. Be familiar with the Tableau ecosystem and be able to find further learning opportunities

Module-1: Introduction to Tableau

- Dataviz best practices
- Getting started with Tableau Desktop
- Connecting to the tutorial dataset
- Creating the first charts
- Filtering and sorting data

Module--2: Common charts

- Creating common visualizations (bar charts, line charts etc.)
- Assembling a dashboard layout
- Using dashboard filters

Module--3: Transform the data

- Dataviz best practices
- Creating simple calculations in Tableau
- Using table calculations

Module--4: Interactions

- Interactivity with text and visual tooltips
- Interactivity with actions (filter, highlight, URL)
- Drilldown between dashboards

Module--5: Advanced visualizations

- Dataviz best practices
- Creating more advanced chart types
- Using multiple source tables

Module--6: Data Storytelling

- Intro to data storytelling
- Creating a data story in Tableau
- Overview of the Tableau ecosystem
- Further learning opportunities

System Requirements:

• System requirements are listed here under Tableau Desktop and Tableau Prep: https://www.tableau.com/products/techspecs
• The latest version of Tableau Desktop as well as Tableau Prep should be downloaded and installed from here: https://www.tableau.com/tft/activation

TEXTBOOK

1. Visualization Analysis & Design by Tamara Munzner (2014) (ISBN 9781466508910)

REFERENCES BOOKS

1. Interactive Data Visualization for the Web by Scott Murray II Edition (2017)
2. D3.js in Action by Elijah Meeks II Edition (2017)
3. Semiology of Graphics by Jacques Bertin (2010)
4. The Grammar of Graphics by Leland Wilkinson
5. ggplot2 Elegant Graphics for Data Analysis by Hadley Wickham

Course Code	Course Title						Core / Elective
1PW663AD	MINI PROJECT						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

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. 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. - Artificial Intelligence and Data Science

AI&DS 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	1PC713AD	Deep Learning	3	1	0	4	40	60	4
2	1PC714AD	Cryptography & Network Security	3	0	0	3	40	60	3
3	1PC715AD	Cloud Computing	3	0	0	3	40	60	3
4	1PE7(11 to 15) AD	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	1PC764AD	Deep Learning Lab	0	0	2	2	40	60	1
7	1PC765AD	Cryptography & Network Security Lab	0	0	2	2	40	60	1
8	1PW766AD	Project Work – I	0	0	4	4	40	60	2
9	1PW767AD	Summer Internship	-	-	-	-	40	60	2
		Total Credits				**24**	**360**	**540**	**22**

Professional Elective – III

1	1PE711AD	Adhoc Sensor Networks
2	1PE712AD	Big Data Analytics
3	1PE713AD	Software Architecture and Design Patterns
4	1PE714AD	Scripting Languages
5	1PE715AD	Natural Language Processing

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 DEPARTMETS

Course Code	Course Title						Core / Elective
1PC713AD	DEEP LEARNING						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. 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. Illustrate the optimization methods for deep neural networks.
3. Differentiate between various architectures of CNNs, RNN
4. Apply the relevant architecture to applications of Computer Vision and NLP
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 applications 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
1PC714AD	CRYPTOGRAPHY & NETWORK SECURITY						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 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 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
1PC715AD	CLOUD COMPUTING						PC
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Computer Networks	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

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, 2011

Course Code	Course Title						Core / Elective
1PE711AD	ADHOC SENSOR NETWORKS						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Computer Networks	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

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:

After the completion of course the students will be able 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.

Course Code	Course Title						Core / Elective
1PE712AD	BIG DATA ANALYTICS						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 understandtheBigDataPlatform andoverviewofApacheHadoop
2. To Understand HDFSConceptsandInterfacingwithHDFS
3. To understandMap,ReduceJobs
4. To understand HadoopEco System using Pig, Hive
5. To 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 HadoopTypes of Digital Data, Introduction to Big Data, Big Data Analytics, History ofHadoop, Apache Hadoop, Analysing Data with UNIX tools, Analysing 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 ReduceAnatomy 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-IPig: 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 TraditionalDatabases, HiveQL, Tables, Querying Data and User Defined Functions.

UNIT V

Spark Framework: Introduction to GPU Computing, CUDA Programming Model, CUDA API, Simple Matrix, Multiplication in CUDA, CUDA Memory Model, SPA stack framework
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. Mastering Apache Spark:Gain Expertise in Processing and Storing Data by Using Advanced Techniques with Apache Spark, Mike Frampton, Packt Publishing, 2015

REFERENCE BOOKS

1. Big Data Analytics, Seema Acharya, SubhasiniChellappan, Wiley 2015.
2. Intelligent Data Analysis, Michael Berthold, David J. Hand,Springer, 2007.

Course Code	Course Title						Core / Elective
1PE713AD	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:

The objective of this course is to make the student

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 whout 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 incompleteitems, adding a new feature, pattern-based solutions.

AnalyzingArchitectures: 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

Behavioralpatterns: 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. DesignPatterns,ErichGamma,PearsonEducation,1995.

REFERENCE BOOKS

1. BeyondSoftwarearchitecture,LukeHohmann,Addisonwesley,2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
3. SoftwareDesign,DavidBudgen, II edition,Pearsoneducation,2003
4. HeadFirstDesignpatterns, EricFreeman&ElisabethFreeman, O'REILLY,2007.
5. DesignPatternsinJava, StevenJohnMetsker&WilliamC.Wake,Pearsoneducation,2006

Course Code	Course Title						Core / Elective
1PE714AD	SCRIPTING 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

1. To differentiate scripting and non- scripting languages.
2. To understand Scripting languages such as PERL, TCL/TK, python and BASH.
3. To program in the Linux environment.
4. To use 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, Linuxusers 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,

TkFundamentals, 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.

TEXT BOOKS:

1. Practical Programming in Tcl and Tk by Brent Welch and Ken Jones, Updated for Tcl 7.4 and Tk 4.0, Pearson Publications, 4th Edition, 2003.
2. Red Hat Enterprise Linux 4: System Administration Guide Copyright, Red Hat Inc, 2005.

REFERENCE BOOKS:

1. Learning Python – Mark Lutz and David Ascher, II Edition, O'Reilly, 2003.
2. Learning Perl –Randal Schwartz, Tom Phoenix and Brain d foy,IV Edition, 2005.
3. Python Essentials – SamuelePedroni and Noel Pappin. O'Reilly, 2002.
4. Programming Perl – Larry Wall, Tom Christiansen and John Orwant, III Edition, O'Reilly, 2000

Course Code	Course Title						Core / Elective
1PE715AD	NATURAL LANGUAGE PROCESSSING						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Machine Learning	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To understand NLP principles, regular expression to implement text manipulation, pre-processing, normalization with python libraries and real world NLP application development
2. To understand & analyse language modelling
3. To apply finite-state techniques to construct morphological parsing systems and evaluate parts-of-speech tagging methods.
4. To apply text classification, clustering techniques, and phonetics principles using various machine learning models.
5. To apply recurrent networks (RNN, LSTM, GRU) for sequence processing

COURSE OUTCOMES:

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

1. Create real-world NLP applications by synthesizing NLP principles
2. Evaluate language modelling techniques and various text representation methods
3. Analyze and apply morphological parsing systems, finite-state transducers, and parts of speech tagging techniques
4. Analyze and apply text classification methods and phonetics principles
5. Apply recurrent networks for sequence processing and critically analyze NLP applications

UNIT I

Introduction to NLP, Basics of python for NLP (Syntaxes & text data manipulations), Regular expression, Text pre-processing, Text normalizations, NLP tools & libraries, Corpora, NLP application development and real time applications

UNITII

Introduction to language modelling, N-Gram probability estimation and perplexity, and smoothing technique

Text Representations: One hot encoding, Bag-of-words (BoW), TF-IDF, Word embedding's (Word2Vec, GloVe, Fast Text, BERT), Document embedding's (Doc2Vec, TF-IDF weighted averaging) and evaluation metrics.

UNIT III

Words and Transducers: Morphological parsing systems, English morphology, Finite state morphological parsing, construction of finite state lexicon and Finite state transducers

Parts of Speech Tagging: Categories, tagging techniques, Rule based tagging, HMM, transformation based tagging, and Evaluation and error analysis

UNIT IV

Text classification and clustering: Feature Selection, Naive Bayes text classification, k- nearest neighbours, Flat Clustering, K-means algorithm, Hierarchical clustering
Phonetics: Articulatory Phonetics, Acoustic Phonetics (MFCCs, Auditory phonetics, speech synthesis, speech recognitions Gaussian Mixture Models-Universal Background Model (GMM-UBM), Support Vector Machines (SVM), Deep Neural Networks (DNNs), i-vector.

UNIT V

Recurrent Networks and Sequence processing: RNN, Deep networks, LSTM and GRU NLP Applications: Information Extraction, Introduction to Named Entity Recognition and Relation Extraction, Question Answering, Text Summarization and Dialog System.

TEXTBOOKS

1. Speech and language processing: An introduction to natural language processing, computational linguistics, and speech recognition, Martin, James H. Pearson/Prentice Hall, 2009.
2. Foundations of Statistical Natural Language Processing, C. Manning and H. Schutze,MIT Press, 1999
3. Natural language processing with Python: analyzing text with the natural language toolkit, Bird, Steven, Ewan Klein, and Edward Loper, O'Reilly Media, Inc, 2009.

REFERENCE BOOKS

1. Artificial Intelligence with Python: Your complete guide to building intelligent apps using Python 3. x., Artasanchez, Alberto, and Prateek Joshi, Packt Publishing Ltd, 2020.
2. Python for Data Analysis: A Step-By-Step Guide to Master the Basics of Data Science and Analysis in Python Using Pandas, Numpy and Ipython (Volume 2), Andrew Park, Independently Published, 2020.
3. Natural Language Processing, Ela Kumar, IK international Publication, Second Edition, 2014.

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-Hill Science/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.

Course Code	Course Title						Core / Elective
1PC764AD	DEEP LEARNING 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 understand the concepts of Artificial Neural Networks and Deep Learning concepts.
2. To implement ANN and DL algorithms with Tensor flow and Keras.
3. To understand Sequence learning with RNN.
4. To understand Image processing and analysis with CNN
5. To understand advanced concepts of computer vision.

COURSE OUTCOMES:

After the completion of course the students will be able 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 / kerasand 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

Course Code	Course Title						Core / Elective
1PC765AD	CRYPTOGRAPHY AND NETWORK SECURITY 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 explain the objectives of information security
2. To explain the importance and application of each of confidentiality, integrity, authentication and availability
3. To explain various encryption algorithms, hashing functions, and public key cryptology.
4. To analyze challenges in Network security

COURSE OUTCOMES:

After the completion of course the students will be able 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. 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
11. Case study analyzing the different network security algorithms.

Course Code	Course Title						Core / Elective
1PW766AD	PROJECT WORK – I						PW
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 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:

After the completion of course the students will be able 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.

Course Code	Course Title						Core / Elective
1PW767AD	SUMMER INTERNSHIP						PW
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	-	40	60	2

COURSE OBJECTIVES:

The objective of this course is to make the student

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

COURSE OUTCOMES:

After the completion of course the students will be able 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. - Artificial Intelligence and Data Science

AI&DS 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	1HS802HS	Managerial Economics and Financial Accounting	3	0	0	3	40	60	3
2	1PE8(16 to 20) AD	Professional Elective – IV	3	0	0	3	40	60	3
3	1PE8(21 to 25) AD	Professional Elective – V	3	0	0	3	40	60	3
Practical / Laboratory Courses									
4	1PW868AD	Project Work – II	-	-	-	16	50	100	8
		Total Credits				**25**	**170**	**280**	**17**

Professional Elective – IV

1	1PE816AD	Cyber security
2	1PE817AD	Web Mining
3	1PE818AD	Agile Methodologies
4	1PE819AD	Full Stack Development
5	1PE820AD	Soft Computing

Professional Elective – V

1	1PE821AD	Blockchain Technology
2	1PE822AD	Semantic Web and Social Networks
3	1PE823AD	Software Testing Methodologies
4	1PE824AD	Digital marketing and E-Commerce
5	1PE825AD	Nature Inspired Computing

CourseCode	CourseTitle						Core/ Elective
1HS802HS	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

Course Code	Course Title						Core / Elective
1PE816AD	CYBER 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

1. To understand the fundamentals of Cyber Security
2. To understand relevant terminology, concepts in Cyber Security.
3. To familiarize the various types of cyber-attacks and cybercrimes.
4. To apply cyber security to resolve vulnerability and security problems.
5. To understand the broad concepts of technical, social & legal aspects of cyber security.

COURSE OUTCOMES:

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

1. Understand Cyber Security Fundamentals.
2. Gain knowledge about attacker techniques and motivation
3. Gain knowledge about exploitations used by the attackers
4. Understand the various kinds of malicious codes.
5. Gain knowledge about defense and analysis techniques..

UNIT I

Cyber Security Fundamentals: Network and Security Concepts – Information AssuranceFundamentals, Basic Cryptography, Symmetric Encryption, Public KeyEncryption, The DNS, Firewalls.

OS Security Concepts, Microsoft Windows Security Principles –Window Tokens, Window Messaging, Windows Program Execution, TheWindows Firewall.Digital certificates – Concept and implementation details.

UNIT II

Attacker Techniques and Motivations:Usage of Proxies by Attackers, Tunneling techniques.

Fraud Techniques – Phishing, Smishing, Vishing, Mobile malicious code,Rogue antivirus, Click fraud and Ransomware.Threat Infrastructure – Botnets, Fast-Flux, Advanced Fast-Flux.

UNITIII

Exploitation: Stack based buffer overflow, Format string vulnerabilities,SQL injection, Malicious PDF files, Race conditions, DosConditions, Brute Force and dictionary attacks.
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 IV

Malicious Code: Self-replicating malicious code – worms and viruses.Evading detection and, Persistent software techniques,Rootkits, Spyware, Attacksagainst privileged user accounts and escalation of privileges, tokenkidnapping, VM detection.

Stealing information and exploitation – Form grabbing, Man-in-themiddle attacks, DLL injections, Browser Helper objects.

UNIT V

Defence and Analysis techniques: Memory Forensics – Importance and capabilities of memory forensics,Memory analysis frameworks, dumping physical memory, Installing and
using volatility, Finding hidden processes, Volatility Analyst Pack.Honeypots, Malicious code naming, Automated Malicious CodeAnalysis Systems: Passive Analysis, Active Analysis.Intrusion Detection Systems

TEXTBOOKS

1.Cyber Security Essentials, James Graham, Richard Howard, Ryan Olson CRC Press, 2016.
2.Cyber Security,Nina Godbole and SunitBelapure Wiley India,2012.
3.Cryptography and Network Security (principles and approaches), William Stallings,IV Edition. Pearson Education, 2005.

Course Code	Course Title						Core / Elective
1PE817AD	WEB MINING						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 understand the World Wide Web and its history
2. To explain the basic concepts of information retrieval models.
3. To implement text and web page pre-processing techniques.
4. To understand social network analysis and its components, co-citation and bibliographic coupling.
5. To apply Page Rank and HITS algorithms.
6. To Implement wrapper generation and induction techniques.
7. To analyze opinion mining and sentiment analysis

COURSE OUTCOMES:

After the completion of course the students will be able 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

5. Mining the Web-Discovering Knowledge from Hypertext Data,SoumenChakrabartiI Edition - October 9, 2002.
6. Data Mining the Web: Uncovering Patterns in Web Content, Structure, and Usage Zdravko Markov and Daniel T. Larose., Wiley, 2007.

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.

Course Code	Course Title						Core / Elective
1PE818AD	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 understand Agile Software Development, Extreme Programming and Software Development Rhythms.
2. To describe their unique features relative to traditional software practices.
3. To examine their applications in the real world and address their impacts on developing software.

COURSE OUTCOMES:

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

1. Summarize the agile methodologies: extreme programming, scrum, and feature driven programming.
2. Apply the Twelve XP Practices and Illustrate pair programming and its characteristics.
3. Apply XP to a small project.
4. Examine Feature-Driven Development and Regaining Control.
5. Relate Agile Modeling and RUP and Choose Tools to help with Agile Development

UNITI

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

Agile Methods with RUP and PRINCE2 and Tools and Obstacles: Agile Modeling and RUP, FDD and RUP, Agile Methods and Prince2, Tools to Help with Agile Development, Eclipse: An Agile IDE, Obstacles to Agile Software Development, Management Intransigence, The Failed Project Syndrome, Contractual Difficulties, Familiarity with Agility

TEXT BOOKS

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

REFERENCE BOOKS

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

Course Code	Course Title						Core / Elective
1PE819AD	FULL STACK DEVELOPMENT						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Java Programming	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

1. To Create static web pages with HTML and CSS, incorporating basic interactivity using JavaScript and DOM manipulation.
2. To develop interactive user interfaces using React.js, understanding component-based architecture, state management, and API integration.
3. To build RESTful APIs and implement user authentication using Node.js and Express.js, integrating databases for data storage and retrieval.
4. To master advanced database management techniques, including schema design, error handling, and containerization for scalable deployment.
5. To deploy web applications on cloud platforms, implement testing methodologies, and apply project management techniques for efficient software development.

COURSE OUTCOMES:

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

1. Develop interactive and dynamic user interfaces using React.js, including state management and routing.
2. Develop robust server-side applications and RESTful APIs using Node.js and Express.js.
3. Integrate RESTful APIs using Node.js and Express.js with databases and implementing authentication.
4. Demonstrate proficiency in database management, including designing and querying databases, both SQL and NoSQL, and implementing advanced backend functionalities such as authentication and error handling.
5. Deploy web applications to cloud platforms, implement testing strategies, and manage software projects using modern development methodologies.

UNIT I

Frontend Development with React.js: Introduction to React.js and Component-Based Architecture, JSX and Props, State and Lifecycle Methods, Handling Events and Forms in React, React Router for Single Page Applications, State Management with Redux, Integrating APIs with Axios

UNIT II

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, Introduction to Databases: SQL vs NoSQL, working with MongoDB, Authentication and Authorization with JWT, Testing APIs with Postman.

UNIT III

Advanced Backend Development and Database Management: Data Modeling and Relationships in MongoDB, Advanced Querying and Aggregation in MongoDB

UNIT IV

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 V

Deployment, Testing, and Project Management: Continuous Integration and Continuous Deployment (CI/CD), Deploying Applications to Cloud Platforms (e.g., Heroku, AWS), 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, KirupaChinnathambi, Addison-Wesley, 2018
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
1PE820AD	SOFT COMPUTING						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. Artificial Intelligence, Various types of production systems, characteristics of production systems.
2. Neural Networks, architecture, functions and various algorithms involved.
3. Fuzzy Logic, Various fuzzy systems and their functions.
4. Genetic algorithms, its applications and advances.

COURSE OUTCOMES:

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

1. Learn about soft computing techniques and their applications
2. Analyze various neural network architectures
3. Understand perceptron and counter propagation networks.
4. Define the fuzzy systems
5. Analyze the genetic algorithms and their applications.

UNIT I

Soft Computing: Introduction to soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.
Neural Network: Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference b/w ANN and human brain, characteristic and applications of ANN, single layer network.

UNITII

Perceptron: Perceptron training algorithm, Linear separability, Widrow& Hebb's learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BBPA, momentum, limitation, characteristics and application of EBPA.

UNITIII

Counter propagation network: architecture functioning & characteristics of counter Propagation network, Hop field/ Recurrent network, configuration, stability constraints, associative memory, and characteristics, limitations and applications. Hopfield v/s Boltzman machine.
Adaptive Resonance Theory: Architecture, classifications, Implementation and training. Associative Memory.

UNIT IV

Fuzzy Logic: Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions. Fuzzy rule base system: Fuzzy propositions, formation, decomposition & aggregation of fuzzy Rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.

UNIT V

Genetic algorithm: Fundamental, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods.

TEXTBOOKS

1. Principles of Soft ComputingS.N. Sivanandam& S.N. Deepa, Wiley Publications, II Edition, 2011.
2. Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, S Rajasekaran& G.A. VijayalakshmiPai, PHI Publication,I Edition, 2009.

REFERENCE BOOKS

1. N.K.Bose, Ping Liang, Neural Network fundamental with Graph, Algorithms & Applications, TMH, I Edition, 1998.
2. Bart Kosko, Neural Network & Fuzzy System, PHI Publication, I Edition, 2009.
3. Rich E, Knight K, Artificial Intelligence, TMH, III Edition, 2012.
4. George J Klir, Bo Yuan, Fuzzy sets & Fuzzy Logic,Theory& Applications, PHI Publication, I Edition, 2009.
5. Martin T Hagen, Neural Network Design, Nelson Candad, II Edition, 2008.

Course Code	Course Title						Core / Elective
1PE821AD	BLOCKCHAIN TECHNOLOGY						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 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:

After the completion of course the students will be able 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.

Course Code	Course Title						Core / Elective
1PE822AD	SEMANTIC WEB AND SOCIAL NETWORKS						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 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:

After the completion of course the students will be able 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.

Course Code	Course Title						Core / Elective
1PE823AD	SOFTWARE TESTING METHODOLOGIES						PE
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Software Engineering	3	-	-	-	40	60	3

COURSE OBJECTIVES:

The objective of this course is to make the student

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:

After the completion of course the students will be able 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.

Course Code	Course Title						Core / Elective
1PE824AD	DIGITAL MARKETING AND E-COMMERCE						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. 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
1PE825AD	NATURE INSPIRED COMPUTING						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 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:

After the completion of course the students will be able 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 Brief Overview, Individuals, Entities and agents - Parallelism and Distributivity, 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 Behaviour, 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.

Course Code	Course Title						Core / Elective
1PW868AD	PROJECT WORK – II						PW
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	16	50	100	8

COURSE OBJECTIVES:

The objective of this course is to make the student to

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:

After the completion of course the students will be able 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.