MOHAMED SATHAK A.J. COLLEGE OF ENGINEERING

An Autonomous Institution

Department of M.E.
Computer Science and Engineering

Curriculum and Syllabus
(I - IV Semester)
2024 - 2025

[Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai |
Recognised by UGC 12(B) & 2(f) Act | An ISO 9001:2015 Certified |
NAAC Accredited with 'A' Grade | NBA – Mechanical]

34, Rajiv Gandhi Salai (OMR) Siruseri IT Park, Chennai - 603 103

MOHAMED SATHAK A.J. COLLEGE OF ENGINEERING
M.E. COMPUTER SCIENCE AND ENGINEERING
REGULATIONS – 2024
CHOICE BASED CREDIT SYSTEM

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

I. Develop proficiency as a computer science engineer with an ability to solve a wide range of computational problems and have sustainable development in industry or any other work environment.

II. Analyze and adapt quickly to new environments and technologies, gather new information, and work on emerging technologies to solve multidisciplinary engineering problems.

III. Possess the ability to think analytically and logically to understand technical problems with computational systems for a lifelong learning which leads to pursuing research.

IV. Adopt ethical practices to collaborate with team members and team leaders to build technology with cutting-edge technical solutions for computing systems

V. Strongly focus on design thinking and critical analysis to create innovative products and become entrepreneurs.

2. PROGRAM OUTCOMES (POs):

1. An ability to independently carry out research / investigation and development work to solve practical problems.
2. An ability to write and present a substantial technical report/document.
3. Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering.
4. Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms.
5. Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional development in computer and automation arenas.
6. Model a computer based automation system and design algorithms that explore the understanding of the tradeoffs involved in digital transformation.

PEO/PO Mapping:

PEO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
I.	**1**	**2**	**3**	**4**	**5**	**6**
II.	3	2	3	3	3	3
III.	3	3	3	3	2	3
IV.	3	3	2	3	3	2
V.	1	2	3	2	2	2

Contribution 1: Reasonable 2: Significant 3: Strong

Mohamed Sathak A J College of Engineering, Chennai - 603103

(An Autonomous Institution)

Curriculum for the students Admitted from 2024 - 2025

M.E - COMPUTER SCIENCE AND ENGINEERING

SEMESTER I								
S.No	**Subject Code**	**Subject**	**L**	**T**	**P**	**Contact Periods**	**Credits**	**Category**
4	24MAP01	Applied Probability and Statistics for Computer Science Engineers	3	1	0	4	1	FC
2	24RM102	Research Methodology and IPR	2	0	0	2	1	RMC
3	24CP101	Advanced Data Structures and Algorithms	3	0	0	3	3	PCC
4	24CP111	Database Practices	3	0	2	5	4	PCC
5	24CP102	Network Technologies	3	0	0	3	3	PCC
6	24CP103	Principles of Programming Languages	3	0	0	3	3	PCC
7		Audit Course – I*	2	0	0	2	0	AC
8	24CP121	Advanced Data Structures and Algorithms Laboratory	0	0	4	4	2	PCC
Total						**26**	**17**	

SEMESTER II								
S.No	**Subject Code**	**Subject**	**L**	**T**	**P**	**Contact Periods**	**Credits**	**Category**
1	24CP211	Internet of Things	3	0	2	5	4	PCC
2	24CP212	Multicore Architecture and Programming	3	0	2	5	4	PCC
3	24CP213	Machine Learning	3	0	2	5	4	PCC
4	24CP201	Advanced Software Engineering	3	0	0	3	3	PCC
5		Professional Elective I	3	0	0	3	3	PEC
6		Professional Elective II	3	0	0	3	3	PEC
7		Audit Course – II*	2	0	0	2	0	AC
8	24CP221	Term Paper Writing and seminar	0	0	2	2	1	EEC
9	24CP222	Software Engineering Laboratory	0	0	2	2	1	PCC
Total						**30**	**23**	

SEMESTER III								
S.No	**Subject Code**	**Subject**	**L**	**T**	**P**	**Contact Periods**	**Credits**	**Category**
1	24CP301	Security Practices	3	0	0	3	3	PCC
2		Professional Elective III	3	0	0	3	3	PEC
3		Professional Elective IV	3	0	2	5	4	PEC
4		Open Elective	3	0	0	3	3	OEC
5	24CP321	Project Work I	0	0	12	12	6	EEC
Total						**26**	**19**	

SEMESTER IV								
S.No	**Subject Code**	**Subject**	**L**	**T**	**P**	**Contact Periods**	**Credits**	**Category**
1	24CP421	Project Work II	0	0	24	24	12	EEC
Total						**24**	**12**	

TOTAL CREDITS 71

PROFESSIONAL ELECTIVE

VERTICAL I								
S.No	**Subject Code**	**Subject**	**L**	**T**	**P**	**Contact Periods**	**Credits**	**Category**
1	24CP901	Human Computer Interaction	3	0	0	3	3	PEC
2	24CP902	Cloud Computing Technologies	3	0	0	3	3	PEC
3	24CP903	Foundations of Data Science	3	0	0	3	3	PEC
4	24CP904	Wireless Communications	3	0	0	3	3	PEC
5	24CP905	Agile Methodologies	3	0	0	3	3	PEC
6	24CP906	Performance Analysis of Computer Systems	3	0	0	3	3	PEC
7	24CP907	Advanced Operating System	3	0	0	3	3	PEC
8	24CP908	Digital Image Processing	3	0	0	3	3	PEC

VERTICAL II								
S.No	**Subject Code**	**Subject**	**L**	**T**	**P**	**Contact Periods**	**Credits**	**Category**
1	24CP909	High Performance Computing for Big Data	3	0	0	3	3	PEC
2	24CP910	Information Retrieval Techniques	3	0	0	3	3	PEC
3	24CP911	Software Quality Assurance	3	0	0	3	3	PEC
4	24CP912	Autonomous Systems	3	0	0	3	3	PEC
5	24CP913	Web Analytics	3	0	0	3	3	PEC
6	24CP914	Cognitive Computing	3	0	0	3	3	PEC
7	24CP915	Quantum Computing	3	0	0	3	3	PEC
8	24CP916	Big Data Mining and Analytics	3	0	0	3	3	PEC

Chairman BoS Director IQAC Head Academics Principal

VERTICAL III								
S.No	**Subject Code**	**Subject**	**L**	**T**	**P**	**Contact Periods**	**Credits**	**Category**
1	24CP917	Mobile and Pervasive Computing	3	0	0	3	3	PEC
2	24CP918	Web Services and API Design	3	0	0	3	3	PEC
3	24CP919	Data Visualization Techniques	3	0	0	3	3	PEC
4	24CP920	Compiler Optimization Techniques	3	0	0	3	3	PEC
5	24CP921	Formal Models of Software Systems	3	0	0	3	3	PEC
6	24CP922	Robotics	3	0	0	3	3	PEC
7	24CP923	Natural Language Processing	2	0	2	4	3	PEC
8	24CP924	GPU Computing	3	0	0	3	3	PEC

VERTICAL IV								
S.No	**Subject Code**	**Subject**	**L**	**T**	**P**	**Contact Periods**	**Credits**	**Category**
1	24CP925	Devops and Microservices	3	0	0	3	3	PEC
2	24CP926	Mobile Application Development	3	0	0	3	3	PEC
3	24CP927	Deep Learning	3	0	0	3	3	PEC
4	24CP928	Blockchain Technologies	3	0	0	3	3	PEC
5	24CP929	Embedded Software Development	3	0	0	3	3	PEC
6	24CP930	Full Stack Web Application Development	3	0	0	3	3	PEC
7	24CP931	Bioinformatics	3	0	0	3	3	PEC
8	24CP932	Cyber Physical Systems	3	0	0	3	3	PEC
9	24CP933	Mixed Reality						PEC

OPEN ELECTIVE / EMERGING TECHNOLOGY COURSES

S.No	**Subject Code**	**Subject**	**L**	**T**	**P**	**Contact Periods**	**Credits**	**Category**
1	24OE901	Integrated Water Resources Management	3	0	0	3	3	OEC
2	24OE902	Water, Sanitation and Health	3	0	0	3	3	OEC
3	24OE903	Principles of Sustainable Development	3	0	0	3	3	OEC
4	24OE904	Environmental Impact Assessment	3	0	0	3	3	OEC
5	24OE905	Vibration and Noise Control Strategies	3	0	0	3	3	OEC
6	24OE906	Energy Conservation and Management in Domestic Sectors	3	0	0	3	3	OEC
7	24OE907	Additive Manufacturing	3	0	0	3	3	OEC
8	24OE908	Electric Vehicle Technology	3	0	0	3	3	OEC
9	24OE909	New Product Development	3	0	0	3	3	OEC
10	24OE910	Sustainable Management	3	0	0	3	3	OEC
11	24OE911	Micro and Small Business Management	3	0	0	3	3	OEC
12	24OE912	Intellectual Property Rights	3	0	0	3	3	OEC
13	24MGOE3	Ethical Management	3	0	0	3	3	OEC

14	24OE914	IoT for Smart Systems	3	0	0	3	3	OEC
15	24OE915	Machine Learning and Deep Learning	3	0	0	3	3	OEC
16	24OE916	Renewable Energy Technology	3	0	0	3	3	OEC
17	24OE917	Smart Grid	3	0	0	3	3	OEC
18	24OE918	Big Data Analytics	3	0	0	3	3	OEC
19	24OE919	Internet of Things and Cloud	3	0	0	3	3	OEC
20	24OE920	Medical Robotics	3	0	0	3	3	OEC
21	24OE921	Embedded Automation	3	0	0	3	3	OEC
22	24OE922	Environmental Sustainability	3	0	0	3	3	OEC
23	24OE923	Textile Reinforced Composites	3	0	0	3	3	OEC
24	24OE924	Nanocomposite Materials	3	0	0	3	3	OEC
25	24OE925	IPR, Biosafety and Entrepreneurship	3	0	0	3	3	OEC

AUDIT COURSES

S.No	Subject Code	Subject	L	T	P	Contact Periods	Credits	Category
1	24AX901	English for Research Paper Writing	2	0	0	2	0	AC
2	24AX902	Disaster Management	2	0	0	2	0	AC
3	24AX903	Constitution of India	2	0	0	2	0	AC
4	24AX904	நற்றமிழ் இலக்கியம்	2	0	0	2	0	AC

Sl. No.	Subject Type	Credits per semester					
		I	II	III	IV	Total Credits	%
1	FC	1	0	0	0	1	1%
2	PCC	15	16	3	0	34	48%
3	RMC	1	0	0	0	1	1%
4	PEC	0	6	7	0	13	18%
5	AC	0	0	0	0	0	0%
6	EEC	0	1	6	12	19	27%
7	OEC	0	0	3	0	3	4%
Total		**17**	**23**	**19**	**12**	**71**	100%

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University Nominee

APPLIED PROBABILITY AND STATISTICS FOR COMPUTER SCIENCE ENGINEERS

Course Code	24MAP01	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	60	L:T:P	2:1:2	Credits	4
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite : Basic knowledge of mathematics, including algebra, probability fundamentals, and introductory statistics.

Course Objectives: To impart knowledge on

1. To encourage students to develop a working knowledge of the central ideas of Linear Algebra.
2. To enable students to understand the concepts of Probability and Random Variables.
3. To understand the basic probability concepts with respect to two dimensional random variables along with the relationship between the random variables and the significance of the central limit theorem.
4. To apply the small / large sample tests through Tests of hypothesis.
5. To enable the students to use the concepts of multivariate normal distribution and principal components analysis.

UNIT I LINEAR ALGEBRA 12

Vector spaces – norms – Inner Products – Eigenvalues using QR transformations – QR factorization – generalized eigenvectors – Canonical forms – singular value decomposition and applications – pseudo inverse – least square approximations.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II PROBABILITY AND RANDOM VARIABLES 12

Probability – Axioms of probability – Conditional probability – Baye's theorem – Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson , Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III TWO DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Functions of two-dimensional random variables – Regression curve – Correlation.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT IV TESTING OF HYPOTHESIS 12

Sampling distributions – Type I and Type II errors – Small and Large samples – Tests based on Normal, t, Chi square and F distributions for testing of mean , variance and proportions – Tests for independence of attributes and goodness of fit.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT V MULTIVARIATE ANALYSIS 12

Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components – Population principal components – Principal components from standardized variables.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

TOTAL 60

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

After successful completion of this course, the students should be able to

CO1: Apply the concepts of Linear Algebra to solve practical problems.

CO2: Use the ideas of probability and random variables in solving engineering problems.

CO3: Be familiar with some of the commonly encountered two-dimensional random variables and be equipped for a possible extension to multivariate analysis.

CO4: Use statistical tests in testing hypotheses on data.

CO5: Develop critical thinking based on empirical evidence and the scientific approach to knowledge development.

REFERENCES:

1. Dallas E Johnson, "Applied multivariate methods for data Analysis", Thomson and Duxbury press, Singapore, 1998.
2. Richard A. Johnson and Dean W. Wichern, "Applied multivariate statistical Analysis", Pearson Education, Fifth Edition, 6th Edition, New Delhi, 2013.
3. Bronson, R.,"Matrix Operation" Schaum's outline series, Tata McGraw Hill, New York, 2011.
4. Oliver C. Ibe, "Fundamentals of Applied probability and Random Processes", Academic Press, Boston, 2014.
5. Johnson R. A. and Gupta C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson India Education, Asia, 9th Edition, New Delhi, 2017.

CO – PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	1	2	3	-	-	1
2	3	-	2	2	-	3
3	-	-	1	-	3	2
4	2	1	3	2	2	2
5	2	2	1	-	1	2
Avg	2	1.67	2	2	2	2

RESEARCH METHODOLOGY AND IPR

Course Code	24RM102	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	60	L:T:P	2:0:0	Credits	2
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite : Basic understanding of research concepts, technical report writing, and fundamentals of Intellectual Property Rights.

Course Objectives: To impart knowledge on

1. The fundamentals of research methodology, research design, and various approaches to scientific investigation.
2. Data collection techniques, measurement scales, questionnaire design, sampling methods, and data preparation.
3. Data analysis methods, hypothesis testing, multivariate analysis, and effective presentation of research findings.
4. Intellectual Property Rights (IPR), including trademarks, trade secrets, utility models, and the roles of World Intellectual Property Organization, World Trade Organization, and UNESCO.
5. Patent concepts, patent filing procedures, examination, grant, revocation, licensing, and the role of patent agents.

UNIT I **RESEARCH DESIGN** **6**

Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II **DATA COLLECTION AND SOURCES** **6**

Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III DATA ANALYSIS AND REPORTING 6

Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV INTELLECTUAL PROPERTY RIGHTS 6

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Biodiversity, Role of WIPO and WTO inIPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V PATENTS 6

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licenses, Licensing of related patents, patent agents, Registration of patent agents.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL 30

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**
Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: Explain the research process and select appropriate research designs, including qualitative research, observation studies, experiments, and surveys.

CO2: Apply suitable data collection methods, measurement scales, questionnaire design, and sampling techniques for research studies.

CO3: Analyze research data using hypothesis testing, measures of association, and multivariate analysis, and present findings effectively through written and oral reports.

CO4: Describe the concepts, types, and significance of Intellectual Property Rights (IPR), including the roles of World Intellectual Property Organization, World Trade Organization, and UNESCO.

CO5: Explain patent concepts, application procedures, examination, grant, licensing, and the role of patent agents in patent registration and protection.

REFERENCES

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods",Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, TradeSecrets", Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools &techniques", Wiley, 2007.
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament,"Professional Programme Intellectual Property Rights, Law and practice", September 2013.

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	3	2	2	3	2	3
2	3	-	-	-	1	3
3	3	-	-	1	1	2
4	3	-	-	-	1	1
5	3	-	-	1	1	1
Avg	3.00	2.00	2.00	1.67	1.20	2.00

ADVANCED DATA STRUCTURES AND ALGORITHMS

Course Code	24CP101	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite : Basic knowledge of programming, data structures, and design and analysis of algorithms.

Course Objectives: To impart knowledge on

1. To understand the usage of algorithms in computing
2. To learn and use hierarchical data structures and its operations
3. To learn the usage of graphs and its applications
4. To select and design data structures and algorithms that is appropriate for problems
5. To study about NP Completeness of problems.

UNIT I ROLE OF ALGORITHMS IN COMPUTING & COMPLEXITY ANALYSIS **9**

Algorithms – Algorithms as a Technology -Time and Space complexity of algorithms- Asymptotic analysis-Average and worst-case analysis-Asymptotic notation-Importance of efficient algorithms-Program performance measurement - Recurrences: The Substitution Method – The Recursion- Tree Method- Data structures and algorithms.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II HIERARCHICAL DATA STRUCTURES **9**

Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of B -trees – Basic operations on B-Trees – Deleting a key from a B-Tree- Heap – Heap Implementation – Disjoint Sets - Fibonacci Heaps: structure – Mergeable-heap operations- Decreasing a key and deleting a node-Bounding the maximum degree.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III GRAPHS **9**

Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components- Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra‘s Algorithm; Dynamic Programming - All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd-Warshall Algorithm

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT IV ALGORITHMDESIGN TECHNIQUES **9**

Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: – Elements of the Greedy Strategy- An Activity-Selection Problem - Huffman Coding.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT V NP COMPLETE AND NP HARD **9**

NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducibility – NP-Completeness Proofs – NP-Complete Problems.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

TOTAL **45**

SUGGESTED ACTIVITIES:

1. Write an algorithm for Towers of Hanoi problem using recursion and analyze the complexity (No of disc-4)
2. Write any one real time application of hierarchical data structure
3. Write a program to implement Make_Set, Find_Set and Union functions for Disjoint Set Data Structure for a given undirected graph G(V,E) using the linked list representation with simple implementation of Union operation
4. Find the minimum cost to reach last cell of the matrix from its first cell
5. Discuss about any NP completeness problem

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

After successful completion of this course, the students should be able to

CO1: Design data structures and algorithms to solve computing problems.

CO2: Choose and implement efficient data structures and apply them to solve problems.

CO3: Design algorithms using graph structure and various string-matching algorithms to solve real-life problems.

CO4: Design one's own algorithm for an unknown problem.

CO5: Apply suitable design strategy for problem solving.

REFERENCES

1. S.Sridhar," Design and Analysis of Algorithms", Oxford University Press, 1st Edition, 2014.
2. Adam Drozdex, "Data Structures and algorithms in C++", Cengage Learning, 4thEdition, 2013.
3. T.H. Cormen, C.E.Leiserson, R.L. Rivest and C.Stein, "Introduction to Algorithms", Prentice Hall of India, 3rd Edition, 2012.
4. Mark Allen Weiss, "Data Structures and Algorithms in C++", Pearson Education, 3rd Edition, 2009.
5. E. Horowitz, S. Sahni and S. Rajasekaran, "Fundamentals of Computer Algorithms",University Press, 2nd Edition, 2008.
6. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms",Pearson Education, Reprint 2006.

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	3	2	2	3	1	3
2	3	1	-	-	2	3
3	3	-	1	1	-	2
4	3	2	1	-	2	1
5	3	3	1	1	-	1
Avg	3.00	2.00	1.25	1.67	1.67	2.00

DATABASE PRACTICES

Course Code	24CP111	Course Type		INTEGRATED	
Course Offered to	ME-CSE				
Total Teaching Periods	75	L:T:P	3:0:2	Credits	4
Handled by	CSE	Assessment Methods		IAT	ESE
				50 Marks	50 Marks

Prerequisite: Basic knowledge of databases, data types, and SQL commands**.**

Course Objectives: To impart knowledge on

1. Describe the fundamental elements of relational database management systems
2. Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
3. Understand query processing in a distributed database system
4. Understand the basics of XML and create well-formed and valid XML documents.
5. Distinguish the different types of NoSQL databases
6. To understand the different models involved in database security and their applications in real time world to protect the database and information associated with them.

UNIT I RELATIONAL DATA MODEL 15

Entity Relationship Model – Relational Data Model – Mapping Entity Relationship Model to Relational Model – Relational Algebra – Structured Query Language – Database Normalization.

PRACTICALS:

Data Definition Language

- Create, Alter and Drop
- Enforce Primary Key, Foreign Key, Check, Unique and Not Null Constraints
- Creating Views

Data Manipulation Language

- Insert, Delete, Update
- Cartesian Product, Equi Join, Left Outer Join, Right Outer Join and Full Outer Join
- Aggregate Functions
- Set Operations
- Nested Queries

Transaction Control Language

- Commit, Rollback and Save Points

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT II DISTRIBUTED DATABASES, ACTIVE DATABASES AND OPEN DATABASE CONNECTIVITY **15**

Distributed Database Architecture – Distributed Data Storage – Distributed Transactions – Distributed Query Processing – Distributed Transaction Management – Event Condition Action Model – Design and Implementation Issues for Active Databases – Open Database Connectivity.

PRACTICALS:

- Distributed Database Design and Implementation
- Row Level and Statement Level Triggers
- Accessing a Relational Database using PHP, Python and R

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT III XML DATABASES **15**

Structured, Semi structured, and Unstructured Data – XML Hierarchical Data Model – XML Documents – Document Type Definition – XML Schema – XML Documents and Databases – XML Querying – XPath – XQuery

PRACTICALS:

- Creating XML Documents, Document Type Definition and XML Schema
- Using a Relational Database to store the XML documents as text
- Using a Relational Database to store the XML documents as data elements
- Creating or publishing customized XML documents from pre-existing relational databases
- Extracting XML Documents from Relational Databases
- XML Querying

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT IV NOSQL DATABASES AND BIG DATA STORAGE SYSTEMS **15**

NoSQL – Categories of NoSQL Systems – CAP Theorem – Document-Based NoSQL Systems and MongoDB – MongoDB Data Model – MongoDB Distributed Systems Characteristics – NoSQL Key-Value Stores – DynamoDB Overview – Voldemort Key-Value Distributed Data Store – Wide Column NoSQL Systems – Hbase Data Model – Hbase Crud Operations – Hbase Storage and Distributed System Concepts – NoSQL Graph Databases and Neo4j – Cypher Query Language of Neo4j – Big Data – MapReduce – Hadoop – YARN.

PRACTICALS:

- Creating Databases using MongoDB, DynamoDB, Voldemort Key-Value Distributed Data

Store Hbase and Neo4j.

- Writing simple queries to access databases created using MongoDB, DynamoDB, Voldemort Key-Value Distributed Data Store Hbase and Neo4j.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT V DATABASE SECURITY **15**

Database Security Issues – Discretionary Access Control Based on Granting and Revoking Privileges – Mandatory Access Control and Role-Based Access Control for Multilevel Security – SQL Injection – Statistical Database Security – Flow Control – Encryption and Public Key Infrastructures – Preserving Data Privacy – Challenges to Maintaining Database Security – Database Survivability – Oracle Label-Based Security.

PRACTICALS:

- Implementing Access Control in Relational Databases

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

TOTAL : 75

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES

At the end of the course, the students will be able to

CO1: Convert the ER-model to relational tables, populate relational databases and formulate SQL queries on data.

CO2: Understand and write well-formed XML documents

CO3: Be able to apply methods and techniques for distributed query processing.

CO4: Design and Implement secure database systems.

CO5: Use the data control, definition, and manipulation languages of the NoSQL databases

REFERENCES:

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education 2016.
2. Henry F. Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Seventh Edition, McGraw Hill, 2019.

3. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems, Eighth Edition Pearson Education, 2006
4. Raghu Ramakrishnan , Johannes Gehrke "Database Management Systems", Fourth Edition, McGraw Hill Education, 2015.
5. Harrison, Guy, "Next Generation Databases, NoSQL and Big Data" , First Edition, Apress publishers, 2015
6. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Sixth Edition, Pearson Education, 2015

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	2	2	1	3	1	2
2	2	2	-	2	1	1
3	3	1	2	1	-	1
4	3	2	2	1	1	1
5	2	3	1	1	-	1
Avg	2.40	2.00	1.50	1.60	1.00	1.20

NETWORK TECHNOLOGIES

Course Code	24CP102	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of computer fundamentals, data communication concepts.

Course Objectives: To impart knowledge on

1. To understand the basic concepts of networks
2. To explore various technologies in the wireless domain
3. To study about 4G and 5G cellular networks
4. To learn about Network Function Virtualization
5. To understand the paradigm of Software defined networks

UNIT I **NETWORKING CONCEPTS** **9**

Peer To Peer Vs Client-Server Networks. Network Devices. Network Terminology. Network Speeds. Network throughput, delay. Osi Model. Packets, Frames, And Headers. Collision And Broadcast Domains. LAN Vs WAN. Network Adapter. Hub. Switch. Router. Firewall, IP addressing.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II **WIRELESS NETWORKS** **9**

Wireless access techniques- IEEE 802.11a, 802.11g, 802.11e, 802.11n/ac/ax/ay/ba/be, QoS –Bluetooth – Protocol Stack – Security – Profiles – zigbee

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III **MOBILE DATA NETWORKS** **9**

4G Networks and Composite Radio Environment – Protocol Boosters – Hybrid 4G Wireless Networks Protocols – Green Wireless Networks – Physical Layer and Multiple Access – Channel Modelling for 4G – Concepts of 5G – channel access –air interface -Cognitive Radio- spectrum management – C-RAN architecture - Vehicular communications-protocol – Network slicing – MIMO, mmWave, Introduction to 6G.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT IV **SOFTWARE DEFINED NETWORKS** **9**

SDN Architecture. Characteristics of Software-Defined Networking. SDN- and NFV-Related Standards. SDN Data Plane. Data Plane Functions. Data Plane Protocols. Open Flow Logical Network Device. Flow Table Structure. Flow Table Pipeline. The Use of Multiple Tables. Group Table. Open Flow Protocol. SDN Control Plane Architecture. Control Plane Functions. Southbound Interface. Northbound Interface. Routing. ITU-T Model. Open Daylight. Open Daylight Architecture. Open Daylight Helium. SDN Application Plane Architecture. Northbound Interface. Network Services Abstraction Layer. Network Applications. User Interface.

Teaching-Learning Process

Pedagogy: Lecture, PPT

RBT Level: L1- L3

UNIT V **NETWORK FUNCTIONS VIRTUALIZATION** **9**

Motivation-Virtual Machines –NFV benefits-requirements – architecture- NFV Infrastructure - Virtualized Network Functions - NFV Management and Orchestration- NFV Use Cases- NFV and SDN –Network virtualization – VLAN and VPN

Teaching-Learning Process

Pedagogy: Lecture, PPT

RBT Level: L1- L3

TOTAL : **45**

SUGGESTED ACTIVITIES:

1. Execute various network utilities such as tracert, pathping, ipconfig
2. Implement the Software Defined Networking using Mininet
3. Implement routing in Mininet
4. Install a virtual machine and study network virtualization
5. Simulate various network topologies in Network Simulator

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Explain basic networking concepts

CO2: Compare different wireless networking protocols

CO3: Describe the developments in each generation of mobile data networks

CO4: Explain and develop SDN based applications

CO5: Explain the concepts of network function virtualization

REFERENCES

1. James Bernstein, “Networking made Easy”, 2018. (UNIT I)
2. HoudaLabiod, Costantino de Santis, HossamAfifi “Wi-Fi, Bluetooth, Zigbee and WiMax”, Springer 2007 (UNIT 2)
3. Erik Dahlman, Stefan Parkvall, Johan Skold, 4G: LTE/LTE-Advanced for Mobile Broadband, Academic Press, 2013 (UNIT 3)
4. Saad Z. Asif “5G Mobile Communications Concepts and Technologies” CRC press – 2019 (UNIT 3)
5. William Stallings “Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud” 1st Edition, Pearson Education, 2016.(Unit 4 and 5)
6. Thomas D.Nadeau and Ken Gray, SDN – Software Defined Networks, O"Reilly Publishers, 2013.
7. Guy Pujolle, “Software Networks”, Second Edition, Wiley-ISTE, 2020

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	1	3	2	-	1	-
2	1	3	3	3	-	1
3	1	3	3	2	2	2
4	1	2	2	1	2	1
5	1	3	1	1	1	2
Avg	1.00	2.80	2.20	1.75	1.50	1.50

PRINCIPLES OF PROGRAMMING LANGUAGES

Course Code	24CP103	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of programming concepts, data structures, discrete mathematics, and formal languages.

Course Objectives: To impart knowledge on

1. To understand and describe syntax and semantics of programming languages
2. To understand data, data types, and basic statements
3. To understand call-return architecture and ways of implementing them
4. To understand object-orientation, concurrency, and event handling in
5. programming languages
6. To develop programs in non-procedural programming paradigms

UNIT I SYNTAX AND SEMANTICS 9

Evolution of programming languages – describing syntax – context – free grammars –attribute grammars – describing semantics – lexical analysis – parsing – recursive-descent – bottom- up Parsing

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT II DATA, DATA TYPES, AND BASIC STATEMENTS 9

Names – variables – binding – type checking – scope – scope rules – lifetime and garbage collection –primitive data types–strings–array types– associative arrays–record types– union types – pointers and references – Arithmetic expressions – overloaded operators – type conversions – relational and boolean expressions – assignment statements – mixed- mode assignments – control structures – selection – iterations – branching – guarded statements

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III SUBPROGRAMS AND IMPLEMENTATIONS 9

Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions – semantics of call and return – implementing simple subprograms – stack and dynamic local variables – nested subprograms – blocks – dynamic scoping

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV **OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING** **9**

Object-orientation – design issues for OOP languages – implementation of object-oriented constructs – concurrency – semaphores – monitors – message passing – threads – statement level concurrency – exception handling – event handling

Pedagogy: Lecture, PPT

Teaching-Learning Process **RBT Level:** L1- L3

UNIT V **FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES** **9**

Introduction to lambda calculus – fundamentals of functional programming languages – Programming with Scheme – Programming with ML – Introduction to logic and logic programming – Programming with Prolog – multi-paradigm languages

Pedagogy: Lecture, PPT

Teaching-Learning Process **RBT Level:** L1- L3

TOTAL **45**

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

After successful completion of this course, the students should be able to

CO1: Describe syntax and semantics of programming languages

CO2: Explain data, data types, and basic statements of programming languages

CO3: Design and implement subprogram constructs

CO4: Apply object-oriented, concurrency, and event handling programming constructs

CO5: Develop programs in Scheme, ML, and Prolog and Understand and adopt new programming language

REFERENCES:

1. Robert W. Sebesta, "Concepts of Programming Languages", Eleventh Edition, Addison Wesley,2012
2. W. F. Clocksin and C. S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003
3. Michael L.Scott, "Programming Language Pragmatics", Fourth Edition,MorganKaufmann,2009.
4. R.KentDybvig,"TheSchemeprogramminglanguage",FourthEdition,MITPress, 2009
5. Richard A. O'Keefe, "The craft of Prolog", MIT Press, 2009
6. W.F.ClocksinandC.S.Mellish,"ProgramminginProlog:UsingtheISOStandard",Fifth Edition, Springer,2003

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	1	-	-	-	-	1
2	1	-	1	-	1	2
3	1	1	-	-	1	2
4	-	2	1	1	2	2
5	1	2	1	-	2	3
Avg	1.00	1.67	1.00	1.00	1.50	2.00

ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY

Course Code	24CP121	Course Type		PRACTICAL	
Course Offered to	ME-CSE				
Total Teaching Periods	60	L:T:P	0:0:4	Credits	2
Handled by	CSE	Assessment Methods		IAT	ESE
				60 Marks	40 Marks

Prerequisite : Data Structures and Programming Fundamentals**.**

Course Objectives: To impart the knowledge of

1. To acquire the knowledge of using advanced tree structures
2. To learn the usage of heap structures
3. To understand the usage of graph structures and spanning trees
4. To understand the problems such as matrix chain multiplication, activity selection and Huffman coding
5. To understand the necessary mathematical abstraction to solve problems.

LIST OF EXPERIMENTS:

1: Implementation of recursive function for tree traversal and Fibonacci

2: Implementation of iteration function for tree traversal and Fibonacci

3: Implementation of Merge Sort and Quick Sort

4: Implementation of a Binary Search Tree

5: Red-Black Tree Implementation

6: Heap Implementation

7: Fibonacci Heap Implementation

8: Graph Traversals

9: Spanning Tree Implementation

10: Shortest Path Algorithms (Dijkstra's algorithm, Bellman Ford Algorithm)

11: Implementation of Matrix Chain Multiplication

12: Activity Selection and Huffman Coding Implementation

HARDWARE/SOFTWARE REQUIREMENTS

1. 64-bit Open source Linux or its derivative
2. Open Source C++ Programming tool like G++/GCC

TOTAL **60**

Suggested Activities : Mini project/Content beyond syllabus

Evaluation Methods: Performance in Suggested activities and End Semester Examinations.

REFERENCES:

R1: Lipschutz Seymour, "Data Structures Schaum's Outlines Series", Tata McGraw Hill, 3rd Edition, 2014.

R2: Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.

Web links and Video Lectures (e-Resources):

1. **http://www.coursera.org/specializations/data-structures-algorithms**
2. **http://www.tutorialspoint.com/data_structures_algorithms**
3. **http://www.geeksforgeeks.org/data-structures/**

CO-PO Mapping:

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	1	1	-	1	1	-
2	1	-	1	2	2	1
3	1	1	1	1	2	1
4	1	2	2	2	2	1
5	1	2	3	1	3	1
Avg	1.00	1.50	1.75	1.40	2.00	1.00

INTERNET OF THINGS

Course Code	24CP211	Course Type		INTEGRATED	
Course Offered to	ME-CSE				
Total Teaching Periods	75	L:T:P	3:0:2	Credits	4
Handled by	CSE	Assessment Methods		IAT	ESE
				60 Marks	40 Marks

Prerequisite : Basic knowledge of Programming, Computer Networks, and Electronics.

Course Objectives: To impart the knowledge of

1. To Understand the Architectural Overview of IoT
2. To Understand the IoT Reference Architecture and Real-World Design Constraints
3. To Understand the various IoT levels
4. To understand the basics of cloud architecture
5. To gain experience in Raspberry PI and experiment simple IoT application.

UNIT I INTRODUCTION **9+6**

Internet of Things- Domain Specific IoTs - IoT and M2M-Sensors for IoT Applications–Structure of IoT–IoT Map Device- IoT System Management with NETCONF-YANG

Teaching-Learning Process

Pedagogy: Chalk and Talk, PPT

RBT Level: L1- L4

UNIT II IoT ARCHITECTURE, GENERATIONS AND PROTOCOLS **9+6**

IETF architecture for IoT - IoT reference architecture -First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics

Teaching-Learning Process

Pedagogy: Chalk and Talk, PPT

RBT Level: L1- L4

UNIT III IoT PROTOCOLS AND TECHNOLOGY **9+6**

SCADA and RFID Protocols - BACnet Protocol -Zigbee Architecture - 6LowPAN - CoAP -Wireless Sensor Structure–Energy Storage Module–Power Management Module–RF Module–Sensing Module

Teaching-Learning Process

Pedagogy: Chalk and Talk, PPT

RBT Level: L1- L4

UNIT IV CLOUD ARCHITECTURE BASICS 9+6

The Cloud types; IaaS, PaaS, SaaS.- Development environments for service development; Amazon, Azure, Google Appcloud platform in industry

Teaching-Learning Process	**Pedagogy:** Chalk and Talk, PPT **RBT Level:** L1- L4

UNIT V IOT PROJECTS ON RASPBERRY PI 9+6

Building IOT with RASPBERRY PI- Creating the sensor project - Preparing Raspberry Pi - Clayster libraries – Hardware Interacting with the hardware - Interfacing the hardware- Internal representation of sensor values - Persisting data - External representation of sensor values - Exporting sensor data

Teaching-Learning Process	**Pedagogy:** Chalk and Talk, PPT **RBT Level:** L1- L4

SUGGESTED ACTIVITIES:

1. Develop an application for LED Blink and Pattern using Arduino or Raspberry Pi
2. Develop an application for LED Pattern with Push Button Control using Arduino or Raspberry Pi
3. Develop an application for LM35 Temperature Sensor to display temperature values using arduino or Raspberry Pi
4. Develop an application for Forest fire detection end node using Raspberry Pi device and sensor
5. Develop an application for home intrusion detection web application
6. Develop an application for Smart parking application using python and Django for web application

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations.

COURSE OUTCOMES:

After successful completion of this course, the students should be able to

CO1: Understand the various concept of the IoT and their technologies

CO2: Develop the IoT application using different hardware platforms

CO3: Implement the various IoT Protocols

CO4: Understand the basic principles of cloud computing

CO5: Develop and deploy the IoT application into cloud environment

TOTAL **75**

REFERENCES:

R1: Arshdeep Bahga, Vijay Madisetti, Internet of Things: A hands-on approach, Universities Press, 2015

R2: Dieter Uckelmann, Mark Harrison, Florian Michahelles (Eds), Architecting the Internet of Things,Springer, 2011

R3: Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015

R4: Ovidiu Vermesan Peter Friess, 'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014

R5: N. Ida, Sensors, Actuators and Their Interfaces: A Multidisciplinary Introduction, 2nd EditionScitech Publishers, 202014

R6: Reese,G.(2009). Cloud Application Architectures: Building Applications and Infrastructure in the Cloud. Sebastopol, CA: O'Reilly Media, Inc. (2009)

CO-PO MAPPING:

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	1	1	2	1	1	3
2	3	2	1	2	3	2
3	1	1	2	1	3	3
4	2	3	2	1	2	2
5	1	2	1	2	1	1
Avg	1.60	1.80	1.60	1.40	2.00	2.20

MULTICORE ARCHITECTURE AND PROGRAMMING

Course Code	24CP212	Course Type		INTEGRATED	
Course Offered to	ME-CSE				
Total Teaching Periods	75	L:T:P	3:0:2	Credits	4
Handled by	CSE	Assessment Methods		IAT	ESE
				50 Marks	50 Marks

Prerequisite : Knowledge of Computer Architecture, Operating Systems, and C/C++ Programming**.**

Course Objectives: To impart the knowledge of

1. To understand the need for multi-core processors, and their architecture.
2. To understand the challenges in parallel and multithreaded programming.
3. To learn about the various parallel programming paradigms,
4. To develop multicore programs and design parallel solutions.

UNIT I MULTI-CORE PROCESSORS 9

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks – Symmetric and Distributed Shared Memory Architectures – Cache coherence – Performance Issues – Parallel program design.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT II PARALLEL PROGRAM CHALLENGES 9

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT III SHARED MEMORY PROGRAMMING WITH OpenMP 9

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs – Library functions – Handling Data and Functional Parallelism – Handling Loops – Performance Considerations.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI 9

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT V PARALLEL PROGRAM DEVELOPMENT 9

Case studies – n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

PRACTICALS:

1. Write a simple Program to demonstrate an OpenMP Fork-Join Parallelism.
2. Create a program that computes a simple matrix-vector multiplication b=Ax, either in C/C++. Use OpenMP directives to make it run in parallel.
3. Create a program that computes the sum of all the elements in an array A (C/C++) or a
    a. program that finds the largest number in an array A. Use OpenMP directives to make it run in parallel.
    b. Write a simple Program demonstrating Message-Passing logic using OpenMP.
4. Implement the All-Pairs Shortest-Path Problem (Floyd's Algorithm) Using OpenMP.
5. Implement a program Parallel Random Number Generators using Monte Carlo Methods in OpenMP.
6. Write a Program to demonstrate MPI-broadcast-and-collective-communication in C.
7. Write a Program to demonstrate MPI-scatter-gather-and-all gather in C.
8. Write a Program to demonstrate MPI-send-and-receive in C.
9. Write a Program to demonstrate by performing-parallel-rank-with-MPI in C.

TOTAL 75

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

At the end of the course, the students should be able to:

CO1: Describe multicore architectures and identify their characteristics and challenges.

CO2: Identify the issues in programming Parallel Processors.

CO3: Write programs using OpenMP and MPI.

CO4: Design parallel programming solutions to common problems.

CO5: Compare and contrast programming for serial processors and programming for parallel processors.

REFERENCES:

1. Peter S. Pacheco, "An Introduction to Parallel Programming, Morgan-Kauffman/Elsevier, 2021.
2. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris, Pearson, 2011 (unit 2)
3. Michael J Quinn, "Parallel programming in C with MPI and OpenMP, Tata McGraw Hill,2003.
4. Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
5. Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.

CO-PO Mapping

CO	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	1	2	3	4	5	6
2	1	1	1	2	1	2
3	2	1	-	-	2	2
4	1	-	2	1	1	2
5	2	1	1	1	2	2
6	3	1	2	1	2	3
Avg	1.80	1.00	1.50	1.25	1.60	2.20

MACHINE LEARNING

Course Code	24CP213	Course Type		INTEGRATED	
Course Offered to	ME-CSE				
Total Teaching Periods	75	L:T:P	3:0:2	Credits	4
Handled by	CSE	Assessment Methods		IAT 50 Marks	ESE 50 Marks

Prerequisite : Basic knowledge of Programming, Mathematics (Probability & Statistics, Linear Algebra), and Data Structures.

Course Objectives: To impart the knowledge of

1. To understand the concepts and mathematical foundations of machine learning and types of problems tackled by machine learning
2. To explore the different supervised learning techniques including ensemble methods
3. To learn different aspects of unsupervised learning and reinforcement learning
4. To learn the role of probabilistic methods for machine learning
5. To understand the basic concepts of neural networks and deep learning

UNIT I INTRODUCTION AND MATHEMATICAL FOUNDATIONS 9

What is Machine Learning? Need –History – Definitions – Applications - Advantages, Disadvantages & Challenges -Types of Machine Learning Problems – Mathematical Foundations - Linear Algebra & Analytical Geometry -Probability and Statistics- Bayesian Conditional Probability -Vector Calculus & Optimization - Decision Theory - Information theory

Teaching-Learning Process

Pedagogy: Chalk and Talk, PPT

RBT Level: L1- L4

UNIT II SUPERVISED LEARNING 9

Introduction-Discriminative and Generative Models -Linear Regression - Least Squares -Under-fitting / Overfitting -Cross-Validation – Lasso Regression- Classification - Logistic Regression- Gradient Linear Models -Support Vector Machines –Kernel Methods -Instance based Methods - K-Nearest Neighbors - Tree based Methods –Decision Trees –ID3 – CART - Ensemble Methods –Random Forest - Evaluation of Classification Algorithms

Teaching-Learning Process

Pedagogy: Chalk and Talk, PPT

RBT Level: L1- L4

UNIT III UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING 9

Introduction - Clustering Algorithms -K – Means – Hierarchical Clustering - Cluster Validity - Dimensionality Reduction –Principal Component Analysis – Recommendation Systems - EM algorithm. Reinforcement Learning – Elements -Model based Learning – Temporal Difference Lerning

Teaching-Learning Process **Pedagogy:** Chalk and Talk, PPT

RBT Level: L1- L4

UNIT IV PROBABILISTIC METHODS FOR LEARNING 9

Introduction -Naïve Bayes Algorithm -Maximum Likelihood -Maximum Apriori -Bayesian Belief Networks-Probabilistic Modelling of Problems -Inference in Bayesian Belief Networks – Probability Density Estimation - Sequence Models – Markov Models – Hidden Markov Models

Teaching-Learning Process **Pedagogy:** Chalk and Talk, PPT

RBT Level: L1- L4

UNIT V NEURAL NETWORKS AND DEEP LEARNING 9

Neural Networks – Biological Motivation- Perceptron – Multi-layer Perceptron – Feed Forward Network– Back Propagation-Activation and Loss Functions- Limitations of Machine Learning – Deep Learning– Convolution Neural Networks – Recurrent Neural Networks – Use cases

Teaching-Learning Process **Pedagogy:** Chalk and Talk, PPT

RBT Level: L1- L4

SUGGESTED ACTIVITIES:

1. Give an example from our daily life for each type of machine learning problem
2. Study at least 3 Tools available for Machine Learning and discuss pros & cons of each
3. Take an example of a classification problem. Draw different decision trees for the example and explain the pros and cons of each decision variable at each level of the tree
4. Outline 10 machine learning applications in healthcare
5. Give 5 examples where sequential models are suitable.
6. Give at least 5 recent applications of CNN

PRACTICAL EXERCISES:

Implement a Linear Regression with a Real Dataset (https://www.kaggle.com/harrywang/housing). Experiment with different features in building a model. Tune the model's hyperparameters.

1. Implement a binary classification model. That is, answers a binary question such as "Are houses in this neighborhood above a certain price?"(use data from exercise 1). Modify the classification threshold and determine how that modification influences the model. Experiment with different classification metrics to determine your model's effectiveness.
2. Classification with Nearest Neighbors. In this question, you will use the scikit-learn's KNN classifier to classify real vs. fake news headlines. The aim of this question is for you to read the scikit-learn API and get comfortable with training/validation splits. Use California Housing Dataset
3. In this exercise, you'll experiment with validation sets and test sets using the dataset. Split a training set into a smaller training set and a validation set. Analyze deltas between training set and validation set results. Test the trained model with a test set to determine whether your trained model is overfitting. Detect and fix a common training problem.
4. Implement the k-means algorithm using https://archive.ics.uci.edu/ml/datasets/Codon+usage dataset
5. Implement the Naïve Bayes Classifier using https://archive.ics.uci.edu/ml/datasets/Gait+Classification dataset
6. Project - (in Pairs) Your project must implement one or more machine learning algorithms and apply them to some data.
    a. Your project may be a comparison of several existing algorithms, or it may propose a new algorithm in which case you still must compare it to at least one other approach.
    b. You can either pick a project of your own design, or you can choose from the set of pre-defined projects.
    c. You are free to use any third-party ideas or code that you wish as long as it is publicly available.
    d. You must properly provide references to any work that is not your own in the write-up.
    e. Project proposal You must turn in a brief project proposal. Your project proposal should describe the idea behind your project. You should also briefly describe software you will need to write, and papers (2-3) you plan to read.

List of Projects (datasets available)

1. Sentiment Analysis of Product Reviews
2. Stock Prediction
3. Sales Forecasting
4. Music Recommendation
5. Handwriting Digit Classification
6. Fake News Detection

7. Sports Prediction
8. Object Detection
9. Disease Prediction

TOTAL 75

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations.

COURSE OUTCOMES:

Upon the completion of course, students will be able to

CO1: Understand and outline problems for each type of machine learning

CO2: Design a Decision tree and Random forest for an application

CO3: Implement Probabilistic Discriminative and Generative algorithms for an application and analyze the results.

CO4: Use a tool to implement typical Clustering algorithms for different types of applications.

CO5: Design and implement an HMM for a Sequence Model type of application and identify applications suitable for different types of Machine Learning with suitable justification.

REFERENCES

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2. Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012
3. Ethem Alpaydin, "Introduction to Machine Learning", Third Edition, Adaptive Computation and Machine Learning Series, MIT Press, 2014
4. Tom M Mitchell, "Machine Learning", McGraw Hill Education, 2013.
5. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.
6. Shai Shalev-Shwartz and Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2015
7. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.
8. Hal Daumé III, "A Course in Machine Learning", 2017 (freely available online)
9. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, 2009 (freely available online)
10. Aurélien Géron , Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition, o'reilly, (2017)

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	1	2	1	3	1	1
2	2	3	1	2	1	2
3	1	1	2	1	-	2
4	2	2	-	-	-	3
5	3	3	1	1	1	3
Avg	1.80	2.20	1.25	1.75	1.00	2.20

ADVANCED SOFTWARE ENGINEERING

Course Code	24CP201	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				60 Marks	40 Marks

Prerequisite : Knowledge of Programming, Software Engineering, Data Structures, and Database Management Systems.

Course Objectives: To impart the knowledge of

1. To understand the rationale for software development process models
2. To understand why the architectural design of software is important;
3. To understand the five important dimensions of dependability, namely, availability, reliability, safety, security, and resilience.
4. To understand the basic notions of a web service, web service standards, and service-oriented architecture;
5. To understand the different stages of testing from testing during development of a software system

UNIT I SOFTWARE PROCESS &MODELING 9

Prescriptive Process Models – Agility and Process – Scrum – XP – Kanban – DevOps – Prototype Construction – Prototype Evaluation – Prototype Evolution – Modelling – Principles – Requirements Engineering – Scenario-based Modelling – Class-based Modelling – Functional Modelling – Behavioural Modelling.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II SOFTWARE DESIGN 9

Design Concepts – Design Model – Software Architecture – Architectural Styles – Architectural Design – Component-Level Design – User Experience Design – Design for Mobility – Pattern- Based Design.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III SYSTEM DEPENDABILITY AND SECURITY 9

Dependable Systems – Dependability Properties – Sociotechnical Systems – Redundancy and Diversity – Dependable Processes – Formal Methods and Dependability – Reliability Engineering – Availability and Reliability – Reliability Requirements – Fault-tolerant Architectures – Programming for Reliability – Reliability Measurement – Safety Engineering – Safety-critical Systems – Safety

Requirements – Safety Engineering Processes – Safety Cases – Security Engineering – Security and Dependability – Safety and Organizations – Security Requirements – Secure System Design – Security Testing and Assurance – Resilience Engineering – Cybersecurity – Sociotechnical Resilience – Resilient Systems Design.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV SERVICE-ORIENTED SOFTWARE ENGINEERING, SYSTEMS ENGINEERING AND REAL-TIME SOFTWARE ENGINEERING 9

Service-oriented Architecture – RESTful Services – Service Engineering – Service Composition – Systems Engineering – Sociotechnical Systems – Conceptual Design – System Procurement – System Development – System Operation and Evolution – Real-time Software Engineering – Embedded System Design – Architectural Patterns for Real-time Software – Timing Analysis – Real- time Operating Systems.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V SOFTWARE TESTING AND SOFTWARE CONFIGURATION MANAGEMENT 9

Software Testing Strategy – Unit Testing – Integration Testing – Validation Testing – System Testing – Debugging – White-Box Testing – Basis Path Testing – Control Structure Testing – Black-Box Testing – Software Configuration Management (SCM) – SCM Repository – SCM Process – Configuration Management for Web and Mobile Apps.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

SUGGESTED ACTIVITIES

1. Comparatively analysing different Agile methodologies.
2. Describing the scenarios where 'Scrum' and 'Kanban' are used.
3. Mapping the data flow into suitable software architecture.
4. Developing behavioural representations for a class or component.
5. Implementing simple applications as RESTful service.

TOTAL 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations.

COURSE OUTCOMES:

The Students will be able to

CO1:Identify appropriate process models based on the Project requirements

CO2: Understand the importance of having a good Software Architecture.

CO3:Understand the five important dimensions of dependability, namely, availability, reliability, safety, security, and resilience.

CO4: Understand the basic notions of a web service, web service standards, and service-oriented architecture;

CO5: Be familiar with various levels of Software testing

REFERENCES:

1. Software Engineering: A Practitioner's Approach, 9th Edition. Roger Pressman and Bruce Maxim, McGraw-Hill 2019.
2. Software Engineering, 10th Edition, Ian Somerville, Pearson Education Asia 2016.
3. Software Architecture In Practice, 3rd Edition, Len Bass, Paul Clements and Rick Kazman, Pearson India 2018
4. An integrated approach to Software Engineering, 3rd Edition, Pankaj Jalote, Narosa Publishing House, 2018
5. Fundamentals of Software Engineering, 5th Edition, Rajib Mall, PHI Learning Private Ltd, 2018

TERM PAPER WRITING AND SEMINAR

Course Code	24CP221	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	30	L:T:P	0:0:2	Credits	1
Handled by	CSE	Assessment Methods		IAT	ESE
				60 Marks	40 Marks

Prerequisite : Basic knowledge of Research Methodology, Technical Writing, and Presentation Skills.

In this course, students will develop their scientific and technical reading and writing skills that they need to understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas. The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic
2. Stating an objective.
3. Collecting the relevant bibliography (atleast 15 journal papers)
4. Preparing a working outline.
5. Studying the papers and understanding the authors contributions and critically analysing each paper.
6. Preparing a working outline
7. Linking the papers and preparing a draft of the paper.
8. Preparing conclusions based on the reading of all the papers.
9. Writing the Final Paper and giving final Presentation

Please keep a file where the work carried out by you is maintained.
Activities to be carried out

Activity	Instructions	Submission week	Evaluation
Selection of area of interest and Topic	You are requested to select an area of interest, topic and state an objective	2nd week	**3 %** Based on clarity of thought, current relevance and clarity in writing
Stating an Objective			

Collecting Information about your area & topic	1. List 1 Special Interest Groups or professional society 2. List 2 journals 3. List 2 conferences, symposia or workshops 4. List 1 thesis title 5. List 3 web presences (mailing lists, forums, news sites) 6. List 3 authors who publish regularly in your area 7. Attach a call for papers (CFP) 8. from your area.	3rd week	**3%** (the selected information must be area specific and of international and national standard)
Collection of Journal papers in the topic in the context of the objective – collect 20 & then filter	• You have to provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar • When picking papers to read - try to: • Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them, • Favour papers from well-known journals and conferences, • Favour "first" or "foundational" papers in the field (as indicated in other people's survey paper), • Favour more recent papers, • Pick a recent survey of the field so you can quickly gain an overview, • Find relationships with respect to each other and to your topic area (classification scheme/categorization) • Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered	4th week	**6%** (the list of standard papers and reason for selection)
Reading and notes for first 5 papers	Reading Paper Process • For each paper form a Table answering the following questions: • What is the main topic of the	5th week	**8%** (the table given should indicate your understanding of the

	article? • What was/were the main issue(s) the author said they want to discuss? • Why did the author claim it was important? • How does the work build on other's work, in the author's opinion? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research? • What did the author say were the important directions for future research? Conclude with limitations/issues not addressed by the paper (from the perspective of your survey)		paper and the evaluation is based on your conclusions about each paper)
Reading and notes for next5 papers	Repeat Reading Paper Process	6th week	**8%** (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)
Reading and notes for final 5 papers	Repeat Reading Paper Process	7th week	**8%** (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)
Draft outline 1 and Linking papers	Prepare a draft Outline, your survey goals, along with a classification / categorization diagram	8th week	**8%** (this component will be evaluated based on the linking and classification among the papers)

Abstract	Prepare a draft abstract and give a presentation	9th week	**6%** (Clarity, purpose and conclusion) **6%** Presentation & Viva Voce
			TOTAL: 30
Introduction Background	Write an introduction and background sections	10th week	**5%**(clarity)
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey	11thweek	**10%** (this component will be evaluated based on the linking and classification among the papers)
Your conclusions	Write your conclusions and future work	12th week	**5%** (conclusions – clarity and your ideas)
Final Draft	Complete the final draft of your paper	13th week	**10%** (formatting, English, Clarity and linking) **4%** Plagiarism Check Report
Seminar	A brief 15 slides on your paper	14th & 15th week	**10%** (based on presentation and Viva-voce)

SOFTWARE ENGINEERING LABORATORY

Course Code	24CP222	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	30	L:T:P	0:0:2	Credits	1
Handled by	CSE	Assessment Methods		IAT	ESE
				60 Marks	40 Marks

Prerequisite : Knowledge of Programming, Object-Oriented Programming, and Software Engineering Fundamentals.

LAB OBJECTIVE:

The Software Engineering Lab has been developed by keeping in mind the following objectives:

1. To impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner through the Web.
2. Present case studies to demonstrate practical applications of different concepts.
3. Provide a scope to students where they can solve small, real-life problems.

LIST OF EXPERIMENTS:

1. Write a Problem Statement to define a title of the project with bounded scope of project
2. Select relevant process model to define activities and related task set for assigned project
3. Prepare broad SRS (Software Requirement Specification) for the above selected projects
4. Prepare USE Cases and Draw Use Case Diagram using modelling Tool
5. Develop the activity diagram to represent flow from one activity to another for software development
6. Develop data Designs using DFD Decision Table & ER Diagram.
7. Draw class diagram, sequence diagram, Collaboration Diagram, State Transition Diagram for the assigned project
8. Write Test Cases to Validate requirements of assigned project from SRS Document
9. Evaluate Size of the project using function point metric for the assigned project
10. Estimate cost of the project using COCOMO and COCOCMOII for the assigned project
11. Use CPM/PERT for scheduling the assigned project
12. Use timeline Charts or Gantt Charts to track progress of the assigned project

TOTAL: 30

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOME:

CO1: Can produce the requirements and use cases the client wants for the software being Produced.

CO2: Participate in drawing up the project plan. The plan will include at least extent and work assessments of the project, the schedule, available resources, and risk management can model and specify the requirements of mid-range software and their architecture.

CO3: create and specify such a software design based on the requirement specification that the software can be implemented based on the design.

CO4: Can assess the extent and costs of a project with the help of several different assessment methods.

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	3	3	3	3	3	3
2	2	3	3	3	2	2
3	3	1	2	2	1	2
4	2	3	1	2	-	-
Avg	2.5	2.5	2.25	2.5	2	2.34

SECURITY PRACTICES

Course Code	24CP301	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite : Basic knowledge of Computer Networks, Operating Systems, and Cyber Security Fundamentals.

Course Objectives: To impart the knowledge of

1. To learn the core fundamentals of system and web security concepts
2. To have through understanding in the security concepts related to networks
3. To deploy the security essentials in IT Sector
4. To be exposed to the concepts of Cyber Security and cloud security
5. To perform a detailed study of Privacy and Storage security and related Issues

UNIT I SYSTEM SECURITY 9

Model of network security – Security attacks, services and mechanisms – OSI security architecture - A Cryptography primer- Intrusion detection system- Intrusion Prevention system - Security web applications- Case study: OWASP - Top 10 Web Application Security Risks.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II NETWORK SECURITY 9

Internet Security - Intranet security- Local Area Network Security - Wireless Network Security - Wireless Sensor Network Security- Cellular Network Security - Mobile security - IOT security - Case Study - Kali Linux.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III SECURITY MANAGEMENT 9

Information security essentials for IT Managers- Security Management System - Policy Driven System Management- IT Security - Online Identity and User Management System. Case study: Metasploit

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV CYBER SECURITY AND CLOUD SECURITY 9

Cyber Forensics- Disk Forensics – Network Forensics – Wireless Forensics – Database Forensics – Malware Forensics – Mobile Forensics – Email Forensics- Best security practices for automate Cloud infrastructure management – Establishing trust in IaaS, PaaS, and SaaS Cloud types. Case study: DVWA.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V PRIVACY AND STORAGE SECURITY 9

Privacy on the Internet - Privacy Enhancing Technologies - Personal privacy Policies - Detection of Conflicts in security policies- privacy and security in environment monitoring systems. Storage Area Network Security - Storage Area Network Security Devices - Risk management - Physical Security Essentials.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations.

Course Outcomes:

After successful completion of this course, the students should be able to

CO1: Understand the core fundamentals of system security

CO2: Apply the security concepts to wired and wireless networks

CO3: Implement and Manage the security essentials in IT Sector

CO4: Explain the concepts of Cyber Security and Cyber forensics

CO5: Be aware of Privacy and Storage security Issues.

REFERENCES

1. John R. Vacca, Computer and Information Security Handbook, Third Edition, Elsevier 2017
2. Michael E. Whitman, Herbert J. Mattord, Principles of Information Security, Seventh Edition, Cengage Learning, 2022
3. Richard E. Smith, Elementary Information Security, Third Edition, Jones and Bartlett Learning, 2019
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5. John Sammons, “The Basics of Digital Forensics- The Primer for Getting Started in Digital Forensics”, Syngress, 2012
6. Cory Altheide and Harlan Carvey, “Digital Forensics with Open Source Tools”,2011 Syngress, ISBN: 9781597495875.
7. Siani Pearson, George Yee "Privacy and Security for Cloud Computing" Computer Communications and Networks, Springer, 2013.

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	1	2	1	1	2	1
2	2	1	3	1	1	2
3	-	-	2	3	3	3
4	2	2	1	2	1	3
5	1	-	1	1	2	3
Avg	1.50	1.67	1.60	1.60	1.80	2.40

HUMAN COMPUTER INTERACTION

Course Code	24CP901	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite : Basic knowledge of Computer Fundamentals, Programming, and User Interface Design.

Course Objectives: To impart the knowledge of

1. To learn the foundations of Human Computer Interaction
2. Understanding Interaction Styles and to become familiar with the design technologies for individuals and persons with disabilities.
3. To understand the process of Evaluation of Interaction Design.
4. To clarify the significance of task analysis for ubiquitous computing
5. To get insight on web and mobile interaction.

UNIT I FOUNDATIONS OF HCI **9**

Context of Interaction –Ergonomics - Designing Interactive systems – Understanding Users- cognition and cognitive frameworks, User Centred approaches Usability, Universal Usability, Understanding and conceptualizing interaction, Guidelines, Principles and Theories. Importance of User Interface: Definition-Importance of good design-Benefits of good design-Human-centered development and Evaluation-Human Performance models-A Brief history of screen design.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II INTERACTION STYLES **9**

GUI: Popularity of graphics - The concept of direct manipulation - Graphical system - Characteristics - Web user - Interface Popularity - Characteristics and Principles of User Interface. Understanding interaction styles, Direct Navigation and Immersive environments, Fluid navigation, Expressive Human and Command Languages, Communication and Collaboration Advancing the user experience, Timely user Experience, Information search, Data Visualization Design process: Human Interaction with computers - Importance of Human Characteristics - Human Consideration - Human Interaction Speeds and Understanding Business Junctions.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III EVALUATION OF INTERACTION 9

Evaluation Techniques- assessing user experience- usability testing – Heuristic evaluation and walkthroughs, analytics predictive models. Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV MODELS AND THEORIES 9

Task analysis, dialog notations and design, Models of the system, Modeling rich interaction, Ubiquitous computing

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V WEB AND MOBILE INTERACTION 9

Hypertext, Multimedia and WWW, Designing for the web Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Use Transitions-Lookup patterns-Feedback patterns Mobile apps, Mobile navigation, content and control idioms, Multi-touch gestures, Inter- app integration, Mobile web

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations.

TOTAL 45

REFERENCES

1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, NiklasElmqvist,“Designing the User Interface: Strategies for Effective Human-Computer Interaction”, Sixth Edition, Pearson Education, 2016.
2. Alan Dix, Janet Finlay, G D Abowd and Russel Beale, "Human Computer Interaction", Pearson Education, Third Edition, 2004.
3. Helen Sharp Jennifer Preece Yvonne Rogers, “Interaction Design: Beyond Human-Computer Interaction”, Wiley, 5th Edition, 2019.
4. Alan Cooper,RobertReimann, David Cronin, Christopher Noessel,“About Face: TheEssentials of Interaction Design”, 4th Edition, Wiley, 2014.
5. Donald A. Norman, “Design of Everyday Things”, MIT Press, 2013.
6. Wilbert O Galitz, "The Essential Guide to User Interface Design", Third Edition, Wiley India Pvt., Ltd., 2007.

CO-PO Mapping

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	3	3	3	3	3	3
2	1	-	1	2	2	1
3	2	3	2	2	-	1
4	2	3	1	2	-	2
5	2	2	3	3	3	3
Avg	2	2.75	2	2.4	2.67	2

CLOUD COMPUTING TECHNOLOGIES

Course Code	24CP902	Course Type	THEORY

Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT 40 Marks	ESE 60 Marks

Prerequisite: Basic knowledge of Computer Networks, Operating Systems, Databases, and Web Technologies.

COURSE OBJECTIVES: To impart the knowledge of

1. To gain expertise in Virtualization, Virtual Machines and deploy practical virtualization solution
2. To understand the architecture, infrastructure and delivery models of cloud computing.
3. To explore the roster of AWS services and illustrate the way to make applications in AWS
4. To gain knowledge in the working of Windows Azure and Storage services offered by Windows Azure
5. To develop the cloud application using various programming model of Hadoop and Aneka

UNIT I VIRTUALIZATION AND VIRTUALIZATION INFRASTRUCTURE **6**

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines –Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization –Management Virtualization — Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization- Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II CLOUD PLATFORM ARCHITECTURE **12**

Cloud Computing: Definition, Characteristics - Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design – Layered cloud Architectural Development – Architectural Design Challenges

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III AWS CLOUD PLATFORM - IAAS 9

Amazon Web Services: AWS Infrastructure- AWS API- AWS Management Console - Setting up AWS Storage - Stretching out with Elastic Compute Cloud - Elastic Container Service for Kubernetes- AWS Developer Tools: AWS Code Commit, AWS Code Build, AWS Code Deploy, AWS Code Pipeline, AWS code Star - AWS Management Tools: Cloud Watch, AWS Auto Scaling, AWS control Tower, Cloud Formation, Cloud Trail, AWS License Manager

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV PAAS CLOUD PLATFORM 9

Windows Azure: Origin of Windows Azure, Features, The Fabric Controller – First Cloud APP in Windows Azure- Service Model and Managing Services: Definition and Configuration, Service runtime API- Windows Azure Developer Portal- Service Management API- Windows Azure Storage Characteristics- Storage Services- REST API- Blops

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V PROGRAMMING MODEL 9

Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster- Aneka: Cloud Application Platform, Thread Programming, Task Programming and Map-Reduce Programming in Aneka

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

TOTAL 45

REFERENCES

1. Bernard Golden, Amazon Web Service for Dummies, John Wiley & Sons, 2013.
2. Raoul Alongi, AWS: The Most Complete Guide to Amazon Web Service from Beginner to Advanced Level, Amazon Asia- Pacific Holdings Private Limited, 2019.
3. Sriram Krishnan, Programming: Windows Azure, O'Reilly,2010.
4. Rajkumar Buyya, Christian Vacchiola, S.Thamarai Selvi, Mastering Cloud Computing , MCGraw Hill Education (India) Pvt. Ltd., 2013.
5. Danielle Ruest, Nelson Ruest, ―Virtualization: A Beginner"s Guidell, McGraw-Hill Osborne Media, 2009.
6. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
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8. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
9. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.

CO-PO Mapping

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	-	-	-	2	2	1
2	2	3	1	-	-	1
3	3	-	3	-	1	3
4	-	-	-	2	-	3
5	3	2	-	-	-	-
Avg	2.6	2.5	2	2	1.5	2

FOUNDATIONS OF DATA SCIENCE

Course Code	24CP903	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Programming, Mathematics, Probability & Statistics, and Databases

COURSE OBJECTIVES: To impart the knowledge of

1. To apply fundamental algorithms to process data.
2. Learn to apply hypotheses and data into actionable predictions.
3. Document and transfer the results and effectively communicate the findings using visualization techniques.
4. To learn statistical methods and machine learning algorithms required for Data Science.
5. To develop the fundamental knowledge and understand concepts to become a data science professional.

UNIT I INTRODUCTION TO DATA SCIENCE 9

Data science process – roles, stages in data science project – working with data from files – working with relational databases – exploring data – managing data – cleaning and sampling for modeling and validation – introduction to NoSQL.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II MODELING METHODS 9

Choosing and evaluating models – mapping problems to machine learning, evaluating clustering models, validating models – cluster analysis – K-means algorithm, Naïve Bayes – Memorization Methods – Linear and logistic regression – unsupervised methods.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III INTRODUCTION TO R 9

Reading and getting data into R – ordered and unordered factors – arrays and matrices – lists and data frames – reading data from files – probability distributions – statistical models in R - manipulating objects – data distribution.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV MAP REDUCE 9

Introduction – distributed file system – algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce – Hadoop - Understanding the Map Reduce architecture - Writing Hadoop MapReduce Programs - Loading data into HDFS - Executing the Map phase - Shuffling and sorting - Reducing phase execution.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V DATA VISUALIZATION 9

Documentation and deployment – producing effective presentations – Introduction to graphical analysis – plot() function – displaying multivariate data – matrix plots – multiple plots in one window - exporting graph using graphics parameters - Case studies.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL : 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Obtain, clean/process and transform data.

CO2: Analyze and interpret data using an ethically responsible approach.

CO3: Use appropriate models of analysis, assess the quality of input, derive insight from results, and investigate potential issues.

CO4: Apply computing theory, languages and algorithms, as well as mathematical and statistical models, and the principles of optimization to appropriately formulate and use data analyses.

CO5: Formulate and use appropriate models of data analysis to solve business-related challenges.

REFERENCES:

1. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 2014.
2. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012.
3. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R", 2013.
4. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, "Practical Data Science Cookbook", Packt Publishing Ltd., 2014.
5. Nathan Yau, "Visualize This: The FlowingData Guide to Design, Visualization, and Statistics", Wiley, 2011.

CO-PO Mapping

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	3	2	3	-	2	2
2	-	-	2	3	-	-
3	1	-	-	-	3	3
4	2	1	-	3	-	-
5	1	-	3	3	-	-
Avg	1.75	1.5	2.7	3	2.5	2.5

WIRELESS COMMUNICATIONS

Course Code	24CP904	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic understanding of Electronic Circuits, Signals and Systems, and Communication Engineering principles.

COURSE OBJECTIVES: To impart the knowledge of

1. To understand the basic concepts in cellular communication.
2. To learn the characteristics of wireless channels.
3. To understand the impact of digital modulation techniques in fading.
4. To get exposed to diversity techniques in wireless communication.

5. To acquire knowledge in multicarrier systems

UNIT I CELLULAR CONCEPTS **9**

Frequency Reuse – Channel Assignment Strategies – Handoff Strategies – Interference and system capacity- Co-Channel Interference- Adjacent Channel Interference – Trunking and Grade of service – Improving coverage & capacity in cellular systems-Cell Splitting- Sectoring- Repeaters for Range Extension-Microcell Zone Concept.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II THE WIRELESS CHANNEL **9**

Overview of wireless systems – Physical modeling for wireless channels – Time and Frequency coherence – Statistical channel models – Capacity of wireless Channel- Capacity of Flat Fading Channel – Channel Side Information at Receiver – Channel Side Information at Transmitter and Receiver –Capacity comparisons – Capacity of Frequency Selective Fading channels.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III PERFORMANCE OF DIGITAL MODULATION OVER WIRELESS CHANNELS **9**

Performance of flat fading and frequency selective fading – Impact on digital modulation techniques –- Outage Probability– Average Probability of Error –– Combined Outage and Average Error Probability – Doppler Spread – Inter symbol Interference.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV DIVERSITY TECHNIQUES **9**

Realization of Independent Fading Paths – Receiver Diversity – Selection Combining – Threshold Combing – Maximal-Ratio Combining – Equal - Gain Combining – Capacity with Receiver diversity – Transmitter Diversity – Channel known at Transmitter – Channel unknown at Transmitter – The Alamouti Scheme– Transmit & Receive Diversity-MIMO Systems.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V MULTICARRIER MODULATION **9**

Data Transmission using Multiple Carriers – Multicarrier Modulation with Overlapping Sub channels – Mitigation of Subcarrier Fading – Discrete Implementation of Multicarrier Modulation – Peak to average Power Ratio- Frequency and Timing offset.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

SUGGESTED ACTIVITIES:

1: Survey on various features of cellular networks

2: Study the nature of cellular networks

3: A comparative study on the performance of different digital modulation techniques

4: Perform a review of various diversity techniques in wireless communication

5: Presentation on design of multicarrier systems for 5G

TOTAL **45**

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Design solutions for cellular communication

CO2: Determine the capacity of wireless channels

CO3: Analyze the performance of the digital modulation techniques in fading channels

CO4: Apply various diversity techniques in wireless communication

CO5: Design multicarrier systems in wireless communication

REFERENCES:

1. Theodore.S. Rappaport, “Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, India, 2010.
2. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005.
3. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Wiley
4. Series in Telecommunications, Cambridge University Press, 2005.
5. Saad Z. Asif, “5G Mobile Communications Concepts and Technologies” CRC press – 2019.
6. Keith Q. T. Zhang, “Wireless Communications: Principles, Theory and Methodology” 1st edition, John Wiley & Sons, 2016.
7. Ramjee Prasad, "OFDM for Wireless Communication Systems", Artech House, 2004.
8. Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”,John Wiley & Sons Inc., 2013.

CO-PO Mapping

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	-	-	2	2	3	2

2	3	2	3	-	-	-
3	2	-	-	2	3	3
4	3	3	-	2	3	3
5	2	3	3	2	3	3
Avg	2.5	2.7	2.7	2	3	2.75

AGILE METHODOLOGIES

Course Code	24CP905	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Software Engineering and Software Development Life Cycle (SDLC).

COURSE OBJECTIVES: To impart the knowledge of

1. To learn the fundamental principles and practices associated with each of the agile development methods
2. To apply the principles and practices of agile software development on a project of interest and relevance to the student.
3. To provide a good understanding of software design and a set of software technologies and APIs.
4. To do a detailed examination and demonstration of Agile development and testing techniques.
5. To understand Agile development and testing.

UNIT I AGILE SOFTWARE DEVELOPMENT 9

Basics and Fundamentals of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, Challenges. Lean Approach: Waste Management, Kaizen and Kanban, add process and products add value. Roles related to the lifecycle, differences between Agile and traditional plans, differences between Agile plans at different lifecycle phases. Testing plan links between testing, roles and key techniques, principles, understand as a means of assessing the initial status of a project/ How Agile helps to build quality

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II AGILE AND SCRUM PRINCIPLES 9

Agile Manifesto, Twelve Practices of XP, Scrum Practices, Applying Scrum. Need of scrum, working of scrum, advanced Scrum Applications, Scrum and the Organization, scrum values

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III AGILE PRODUCT MANAGEMENT **9**

Communication, Planning, Estimation Managing the Agile approach Monitoring progress, Targeting and motivating the team, Managing business involvement, Escalating issue. Quality, Risk, Metrics and Measurements, Managing the Agile approach Monitoring progress, Targeting and motivating the team, Managing business involvement and Escalating issue

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV AGILE REQUIREMENTS AND AGILE TESTING **9**

User Stories, Backlog Management. Agile Architecture: Feature Driven Development. Agile Risk Management: Risk and Quality Assurance, Agile Tools. Agile Testing Techniques, Test-Driven Development, User Acceptance Test

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V AGILE REVIEW AND SCALING AGILE FOR LARGE PROJECTS **9**

Agile Metrics and Measurements, The Agile approach to estimating and project variables, Agile Measurement, Agile Control: the 7 control parameters. Agile approach to Risk, The Agile approach to Configuration Management, The Atern Principles, Atern Philosophy, The rationale for using Atern, Refactoring, Continuous integration, Automated Build Tools. Scrum of Scrums, Team collaborations, Scrum, Estimate a Scrum Project, Track Scrum Projects, Communication in Scrum Projects, Best Practices to Manage Scrum.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Analyze existing problems with the team, development process and wider organization
CO2: Apply a thorough understanding of Agile principles and specific practices
CO3: Select the most appropriate way to improve results for a specific circumstance or need
CO4: Judge and craft appropriate adaptations to existing practices or processes depending upon analysis of typical problems
CO5: Evaluate likely successes and formulate plans to manage likely risks or problems

TOTAL: 45

REFERENCES

1. Robert C. Martin ,Agile Software Development, Principles, Patterns, and Practices Alan Apt Series (2011)

2. Succeeding with Agile : Software Development Using Scrum, Pearson (2010)
3. David J. Anderson and Eli Schragenheim, "Agile Management for Software Engineering:
4. Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
5. Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.
6. Craig Larman, "Agile and Iterative Development: A Managers Guide, Addison-Wesley,2004.
7. Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	3	1	3	-	2	3
2	2	-	3	3	1	3
3	3	-	-	-	3	3
4	2	-	1	2	3	3
5	1	3	-	-	2	3
Avg	2.2	2	2.3	2.5	2.2	3

PERFORMANCE ANALYSIS OF COMPUTER SYSTEMS

Course Code	24CP906	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Computer Organization, Operating Systems, and Probability concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. To understand the mathematical foundations needed for performance evaluation of computer systems
2. To understand the metrics used for performance evaluation
3. To understand the analytical modeling of computer systems
4. To enable the students to develop new queuing analysis for both simple and complex systems
5. To appreciate the use of smart scheduling and introduce the students to analytical techniques for evaluating scheduling policies

UNIT I OVERVIEW OF PERFORMANCE EVALUATION 9

Need for Performance Evaluation in Computer Systems – Overview of Performance Evaluation Methods – Introduction to Queuing – Probability Review – Generating Random Variables for Simulation – Sample Paths, Convergence and Averages – Little‘s Law and other Operational Laws – Modification for Closed Systems.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II MARKOV CHAINS AND SIMPLE QUEUES 9

Discrete-Time Markov Chains – Ergodicity Theory – Real World Examples – Google, Aloha – Transition to Continuous-Time Markov Chain – M/M/1.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III MULTI-SERVER AND MULTI-QUEUE SYSTEMS 9

Server Farms: M/M/k and M/M/k/k – Capacity Provisioning for Server Farms – Time Reversibility and Burke‘s Theorem – Networks of Queues and Jackson Product Form – Classed and Closed Networks of Queues.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV REAL-WORLD WORKLOADS 9

Case Study of Real-world Workloads – Phase-Type Distributions and Matrix-Alalytic Methods – Networks with Time-Sharing Servers – M/G/1 Queue and the Inspection Paradox – Task Assignment Policies for Server Farms.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V SMART SCHEDULING IN THE M/G/1 9

Performance Metrics – Scheduling Non-Preemptive and Preemptive Non-Size-Based Policies - . Scheduling Non-Preemptive and Preemptive Size-Based Policies – Scheduling - SRPT and Fairness.

TOTAL : 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

Upon completion of this course, the students should be able to

CO1: Identify the need for performance evaluation and the metrics used for it

CO2: Distinguish between open and closed queuing networks

CO3: Apply Little‘e law and other operational laws to open and closed systems

CO4: Use discrete-time and continuous-time Markov chains to model real world systems

CO5: Develop analytical techniques for evaluating scheduling policies

REFERENCES:

1. K. S. Trivedi, “Probability and Statistics with Reliability, Queueing and Computer Science Applications‖, John Wiley and Sons, 2001.
2. Krishna Kant, “Introduction to Computer System Performance Evaluation‖, McGraw-Hill, 1992.
3. Lieven Eeckhout, “Computer Architecture Performance Evaluation Methods‖, Morgan and Claypool Publishers, 2010.
4. Mor Harchol - Balter, “Performance Modeling and Design of Computer Systems – Queueing Theory in Action‖, Cambridge University Press, 2013.
5. Paul J. Fortier and Howard E. Michel, “Computer Systems Performance Evaluation and Prediction‖, Elsevier, 2003.
6. Raj Jain, “The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation and Modeling‖, Wiley-Interscience, 1991.
7. Raj Jain, Art of Computer Systems Performance Analysis: Techniques For Experimental Design Measurements Simulation and Modeling,2nd edition, wiley, 2015

CO-PO Mapping

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	1	1	1	1	1	1
2	2	2	3	2	2	1
3	2	2	2		2	
4	1		3		3	1
5	2	2	2	1	2	
Avg	1.60	1.75	2.20	1.33	2.00	1.00

ADVANCED OPERATING SYSTEM

Course Code	24CP907	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Operating Systems, Computer Organization, and Data Structures.

COURSE OBJECTIVES: To impart the knowledge of

1. To get a comprehensive knowledge of the architecture of distributed systems.
2. To understand the deadlock and shared memory issues and their solutions in distributed environments.
3. To know the security issues and protection mechanisms for distributed environments.
4. To get a knowledge of multiprocessor operating systems and database operating systems.

UNIT I INTRODUCTION **9**

Architectures of Distributed Systems - System Architecture types - issues in distributed operating systems - communication networks – communication primitives. Theoretical Foundations - inherent limitations of a distributed system – lamport's logical clocks – vector clocks – causal ordering of messages – global state – cuts of a distributed computation – termination detection. Distributed Mutual Exclusion – introduction – the classification of mutual exclusion and associated algorithms – a comparative performance analysis.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II DISTRIBUTED DEADLOCK DETECTION AND RESOURCE MANAGEMENT 9

Distributed Deadlock Detection -Introduction - deadlock handling strategies in distributed systems – issues in deadlock detection and resolution – control organizations for distributed deadlock detection – centralized and distributed deadlock detection algorithms –hierarchical deadlock detection algorithms. Agreement protocols – introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, applications of agreement algorithms. Distributed resource management: introduction-architecture – mechanism for building distributed file systems – design issues – log structured file systems.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III DISTRIBUTED SHARED MEMORY AND SCHEDULING 9

Distributed shared memory-Architecture– algorithms for implementing DSM – memory coherence and protocols – design issues. Distributed Scheduling – introduction – issues in load distributing – components of a load distributing algorithm – stability – load distributing algorithms – performance comparison – selecting a suitable load sharing algorithm – requirements for load distributing -task migration and associated issues. Failure Recovery and Fault tolerance: introduction– basic concepts – classification of failures – backward and forward error recovery, backward error recovery- recovery in concurrent systems – consistent set of checkpoints – synchronous and asynchronous checkpointing and recovery – check pointing for distributed database systems- recovery in replicated distributed databases.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV DATA SECURITY 9

Protection and security -preliminaries, the access matrix model and its implementations.-safety in matrix model- advanced models of protection. Data security – cryptography: Model of cryptography, conventional cryptography- modern cryptography, private key cryptography, data encryption standard- public key cryptography – multiple encryption – authentication in distributed systems.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT-V MULTIPROCESSOR AND DATABASE OPERATING SYSTEM 9

Multiprocessor operating systems - basic multiprocessor system architectures – interconnection networks for multiprocessor systems – caching – hypercube architecture. Multiprocessor Operating System - structures of multiprocessor operating system, operating system design issues- threads- process synchronization and scheduling. Database Operating systems :Introduction- requirements of

a database operating system Concurrency control : theoretical aspects – introduction, database systems – a concurrency control model of database systems- the problem of concurrency control – serializability theory- distributed database systems, concurrency control algorithms – introduction, basic synchronization primitives, lock based algorithms-timestamp based algorithms, optimistic algorithms – concurrency control algorithms: data replication.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

TOTAL: 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

After the completion of this course, student will be able to

CO1: Understand and explore the working of Theoretical Foundations of OS.

CO2: Analyze the working principles of Distributed Deadlock Detection and resource management

CO3: Understand the concepts of distributed shared memory and scheduling mechanisms

CO4: Understand and analyze the working of Data security

CO5: Apply the learning into multiprocessor system architectures.

REFERENCES:

1. Mukesh Singhal, Niranjan G.Shivaratri, "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", TMH, 2001
2. Andrew S.Tanenbaum, "Modern operating system", PHI, 2003
3. Pradeep K.Sinha, "Distributed operating system-Concepts and design", PHI, 2003.
4. Andrew S.Tanenbaum, "Distributed operating system", Pearson education, 2003.

CO-PO Mapping

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	1	3	2	2	1	3
2	2	2	3	2	1	-
3	1	1	-	3	2	1
4	1	1	2	1	2	2
5	-	-	-	-	-	-
Avg	1.25	1.75	2.33	2.00	1.50	2.00

DIGITAL IMAGE PROCESSING

Course Code	24CP908	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Digital Signal Processing, Mathematics, and Programming.

COURSE OBJECTIVES: To impart the knowledge of

1. To study fundamental concepts of digital image processing.
2. To understand and learn image processing operations and restoration.
3. To use the concepts of Feature Extraction
4. To study the concepts of Image Compression.
5. To expose students to current trends in the field of image segmentation.

UNIT I INTRODUCTION 9

Examples of fields that use digital image processing, fundamental steps in digital image processing, components of image processing system. Digital Image Fundamentals: A simple image formation model, image sampling and quantization, basic relationships between pixels. Image enhancement in the spatial domain: Basic gray-level transformation, histogram processing, enhancement using arithmetic and logic operators, basic spatial filtering, smoothing, and sharpening spatial filters, combining the spatial enhancement methods.

Suggested Activities:

- Discussion of Mathematical Transforms.
- Numerical problem solving using Fourier Transform.
- Numerical problem solving in Image Enhancement.
- External learning – Image Noise and its types.

Suggested Evaluation Methods:

- Tutorial – Image transforms.
- Assignments on histogram specification, histogram equalization and spatial filters.
- Quizzes on noise modeling.

UNIT II IMAGE RESTORATION 9

A model of the image degradation/restoration process, noise models, restoration in the presence of noise–only spatial filtering, Weiner filtering, constrained least squares filtering, geometric transforms; Introduction to the Fourier transform and the frequency domain, estimating the degradation function. Color Image Processing: Color fundamentals, color models, pseudo color image processing, basics of full–color image processing, color transforms, smoothing and sharpening, color segmentation

Suggested Activities:

- Discussion on Image Artifacts and Blur.
- Discussion of Role of Wavelet Transforms in Filter and Analysis.
- Numerical problem solving in Wavelet Transforms.
- External learning – Image restoration algorithms.

Suggested Evaluation Methods:

- Tutorial – Wavelet transforms.
- Assignment problems on order statistics and multi-resolution expansions.
- Quizzes on wavelet transforms.

UNIT III FEATURE EXTRACTION 9

Detection of discontinuities – Edge linking and Boundary detection- Thresholding- -Edge based segmentation-Region based Segmentation- matching-Advanced optimal border and surface detection- Use of motion in segmentation. Image Morphology – Boundary descriptors-Regional descriptors**.**

Suggested Activities:

- External learning – Feature selection and reduction.
- External learning – Image salient features.
- Assignment on numerical problems in texture computation.

Suggested Evaluation Methods:

- Assignment problems on feature extraction and reduction.
- Quizzes on feature selection and extraction.

UNIT IV IMAGE COMPRESSION 9

Fundamentals, image compression models, error-free compression, lossy predictive coding, image compression standards Morphological Image Processing: Preliminaries, dilation, erosion, open and closing, hit or miss transformation, basic morphological algorithms

Suggested Activities:

- Flipped classroom on different image coding techniques.
- Practical – Demonstration of EXIF format for given camera.
- Practical – Implementing effects quantization, color change.
- Case study of Google's WebP image format.

Suggested Evaluation Methods:

- Evaluation of the practical implementations.
- Assignment on image file formats

UNIT V IMAGE SEGMENTATION 9

Detection of discontinuous, edge linking and boundary detection, thresholding, region–based segmentation. Object Recognition: Patterns and patterns classes, recognition based on decision–theoretic methods, matching, optimum statistical classifiers, neural networks, structural methods – matching shape numbers, string matching.

Suggested Activities:

- Flipped classroom on importance of segmentation.

Suggested Evaluation Methods:

- Tutorial – Image segmentation and edge detection.

COURSE OUTCOMES:

CO1: Apply knowledge of Mathematics for image processing operations

CO2: Apply techniques for image restoration.

CO3: Identify and extract salient features of images.

CO4: Apply the appropriate tools (Contemporary) for image compression and analysis.

CO5: Apply segmentation techniques and do object recognition.

TOTAL: 45

REFERENCE:

1. Digital Image Processing, Rafeal C.Gonzalez, Richard E.Woods, Second Edition, Pearson Education/PHI., 2002
2. Digital Image Processing, Sridhar S, Second Edition, Oxford University Press, 2016
3. Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson Course Technology, .Brooks/Cole 2004
4. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis and Machine Vision", Second Edition, Thompson Learning, 2007.
5. Digital Image Processing using Matlab, Rafeal C.Gonzalez, Richard E.Woods, Steven L. Eddins, Pearson Education.Second Edition, 2017

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	2	2	-	3	-	-
2	2	-	3	3	2	3
3	3	3	-	2	-	-
4	3	-	-	2	3	3
5	2	2	2	2	2	3
Avg	2.4	2.3	2.5	2.4	2.3	3

HIGH PERFORMANCE COMPUTING FOR BIG DATA

Course Code	24CP909	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Computer Architecture, Programming, and Big Data concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. To learn the fundamental concepts of High Performance Computing.
2. To learn the network & software infrastructure for high performance computing.
3. To understand real time analytics using high performance computing.
4. To learn the different ways of security perspectives and technologies used in HPC.
5. To understand the emerging big data applications.

UNIT I INTRODUCTION **9**

The Emerging IT Trends- IOT/IOE-Apache Hadoop for big data analytics-Big data into big insights and actions – Emergence of BDA discipline – strategic implications of big data – BDA Challenges – HPC paradigms – Cluster computing – Grid Computing – Cloud computing – Heterogeneous computing – Mainframes for HPC - Supercomputing for BDA – Appliances for BDA.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II NETWORK & SOFTWARE INFRASTRUCTURE FOR HIGH PERFORMANCE BDA **9**

Design of Network Infrastructure for high performance BDA – Network Virtualization – Software Defined Networking – Network Functions Virtualization – WAN optimization for transfer of big data – started with SANs- storage infrastructure requirements for storing big data – FC SAN – IP SAN – NAS – GFS – Panasas – Luster file system – Introduction to cloud storage.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III REAL TIME ANALYTICS USING HIGH PERFORMANCE COMPUTING 9

Technologies that support Real time analytics – MOA: Massive online analysis – GPFS: General parallel file system – Client case studies – Key distinctions – Machine data analytics – operational analytics – HPC Architecture models – In Database analytics – In memory analytics

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV SECURITY AND TECHNOLOGIES 9

Security, Privacy and Trust for user – generated content: The challenges and solutions – Role of real time big data processing in the IoT – End to End Security Framework for big sensing data streams – Clustering in big data.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V EMERGING BIG DATA APPLICATIONS 9

Deep learning Accelerators – Accelerators for clustering applications in machine learning - Accelerators for classification algorithms in machine learning – Accelerators for Big data Genome Sequencing

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL: 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

CO1: Understand the basics concepts of High Performance computing systems.

CO2: Apply the concepts of network and software infrastructure for high performance computing

CO3: Use real time analytics using high performance computing.

CO4: Apply the security models and big data applications in high performance computing

CO5: Understand the emerging big data applications.

REFERENCES:

1. Pethuru Raj, Anupama Raman, Dhivya Nagaraj and Siddhartha Duggirala, "High-Performance Big-Data Analytics: Computing Systems and Approaches", Springer, 1st Edition, 2015.
2. "Big Data Management and Processing", Kuan-Ching Li , Hai Jiang, Albert Y. Zomaya, CRC Press,1st Edition,2017.
3. "High Performance Computing for Big Data: Methodologies and Applications", Chao wang ,CRC Press,1st Edition,2018
4. "High-Performance Data Mining And Big Data Analytics" , Khosrow Hassibi, Create Space Independent Publishing Platform,!st Edition,2014
5. "High performance computing: Modern systems and practices", Thomas Sterling, Matthew Anderson, Morgan Kaufmann publishers,1st Edition,2017

WEB REFERENCES:

1. https://www.hpcwire.com/

ONLINE RESOURCES:

1. http://hpc.fs.uni-lj.si/sites/default/files/HPC_for_dummies.pdf
2. https://www.nics.tennessee.edu/computing-resources/what-is-hpc

CO-PO Mapping

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	2	2	3	1	-	-
2	-	-	2	3	2	3
3	1	-	1	-	1	3
4	3	1	-	-	3	-
5	1	-	-	2	3	-
Avg	1.75	1.5	2	2	2.25	3

INFORMATION RETRIEVAL TECHNIQUES

Course Code	24CP910	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Data Structures, Databases, and Programming concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. To understand the basics of information retrieval with pertinence t o modeling, query operations and indexing
2. To get an understanding of machine learning techniques for text classification and clustering.
3. To understand the various applications of information retrieval giving emphasis to multimedia IR, web search
4. To get an understanding of machine learning techniques for text classification and clustering.
5. To understand the concepts of digital libraries

UNIT I INTRODUCTION: MOTIVATION 9

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval – Retrieval Evaluation – Open-Source IR Systems–History of Web Search – Web Characteristics– The impact of the web on IR —IR Versus Web Search–Components of a Search engine.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II MODELING 9

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model – Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models – Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III INDEXING 9

Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching - Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV EVALUATION AND PARALLEL INFORMATION RETRIEVAL **9**

Traditional Effectiveness Measures – Statistics in Evaluation – Minimizing Adjudication Effect – Nontraditional Effectiveness Measures – Measuring Efficiency – Efficiency Criteria –Queueing Theory – Query Scheduling – Parallel Information Retrieval – Parallel Query Processing – MapReduce

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V SEARCHING THE WEB **9**

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking –b Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and nguages – Indexing and Searching Parallel and Distributed IR – Digital Libraries.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Build an Information Retrieval system using the available tools.

CO2: Identify and design the various components of an Information Retrieval system.

CO3: Categorize the different types of IR Models.

CO4: Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.

CO5: Design an efficient search engine and analyze the Web content structure.

TOTAL: 45

REFERENCES

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, "Introduction to Information Retrieval, Cambridge University Press, First South Asian Edition, 2008.
2. Stefan Buttcher, Implementing and Evaluating Search Engines, The MIT Press, Cambridge, Massachusetts London, England, 2016.
3. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, "Modern Information Retrieval: The concepts and Technology behind Search (ACM Press Books), Second Edition, 2011.
4. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information Retrieval

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	2	2	1	3	3	2
2	1	1	1	3	2	1
3	2	1	2	3	3	3
4	1	2	2	1	2	3
5	2	2	3	3	1	3
Avg	1.60	1.60	1.80	2.60	2.20	2.40

SOFTWARE QUALITY ASSURANCE

Course Code	24CP911	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Software Engineering, SDLC, and Software Testing concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. Be exposed to the software quality factors, Quality Assurance (SQA) architecture and SQA components.
2. Understand the integration of SQA components into the project life cycle.
3. Be familiar with the software quality infrastructure.
4. Be exposed to the management components of software quality.
5. Be familiar with the Quality standards, certifications and assessments

UNIT I INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE **9**

Need for Software quality – Software quality assurance (SQA) – Software quality factors- McCall's quality model – SQA system components – Pre project quality components – Development and quality plans.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II SQA COMPONENTS AND PROJECT LIFE CYCLE **9**

Integrating quality activities in the project life cycle – Reviews – Software Testing – Quality of software maintenance components – Quality assurance for external participants contribution – CASE tools for software quality Management.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III SOFTWARE QUALITY INFRASTRUCTURE **9**

Procedures and work instructions – Supporting quality devices - Staff training and certification - Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT IV SOFTWARE QUALITY MANAGEMENT & METRICS **9**

Project process control – Software quality metrics – Cost of software quality – Classical quality cost model – Extended model – Application and Problems in application of Cost model

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V STANDARDS, CERTIFICATIONS & ASSESSMENTS **9**

Quality management standards – ISO 9001 and ISO 9000-3 –Capability Maturity Models – CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project – SQA project process standards – Organization of Quality Assurance – Role of management in SQA – SQA units and other actors in SQA systems.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Utilize the concepts of SQA in software development life cycle
CO2: Demonstrate their capability to adopt quality standards.
CO3: Assess the quality of software products.
CO4: Apply the concepts in preparing the quality plan & documents.
CO5: Ensure whether the product meets company's quality standards and client's expectations and demands

TOTAL: **45**

REFERENCES

1. Daniel Galin, “Software Quality Assurance”, Pearson Publication, 2009.
2. Alan C. Gillies, “Software Quality: Theory and Management”, International Thomson Computer Press, 2011.
3. Kshirasagar Naim and Priyadarshi Tripathy,” Software Testing and Quality Assurance Theory and Practice”, John Wiley & Sons Inc., 2008
4. Mordechai Ben-Menachem “Software Quality: Producing Practical Consistent Software”, International Thompson Computer Press, 2014

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	3	3	3	3	2	3
2	2	2	2	3	2	3
3	3	1	1	2	1	3
4	2	2	2	3	2	1
5	1	1	1	3	1	2
Avg	2.20	1.80	1.80	2.80	1.60	2.40

AUTONOMOUS SYSTEMS

Course Code	24CP912	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Artificial Intelligence, Robotics, and Programming concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. To impart knowledge on the functional architecture of autonomous vehicles
2. To impart knowledge on Localization and mapping fundamentals
3. To impart knowledge on process end effectors and robotic controls
4. To learn Robot cell design, Robot Transformation and Sensors
5. To learn Micro/Nano Robotic Systems

UNIT I INTRODUCTION AND FUNCTIONAL ARCHITECTURE 9

Functional architecture - Major functions in an autonomous vehicle system, Motion Modeling - Coordinate frames and transforms, point mass model, Vehicle modeling (kinematic and dynamic bicycle model - two-track models), Sensor Modeling - encoders, inertial sensors, GPS.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II PERCEPTION FOR AUTONOMOUS SYSTEMS 9

SLAM - Localization and mapping fundamentals, LIDAR and visual SLAM, Navigation – Global path planning, Local path planning, Vehicle control - Control structures, PID control, Linear quadratic regulator, Sample controllers.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III ROBOTICS INTRODUCTION, END EFFECTORS AND CONTROL **9**

Robot anatomy-Definition, law of robotics, Simple problems Specifications of Robot-Speed of Robot- Robot joints and links-Robot classifications-Architecture of robotic systems, Mechanical grippers- Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers- Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems- Robot controls-Point to point control, Continuous path control, Intelligent robotControl system for robot joint- Control actions-Feedback devices-Encoder, Resolver, LVDT Motion Interpolations- Adaptive control.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT IV ROBOT TRANSFORMATIONS, SENSORS AND ROBOT CELL DESIGN **9**

Robot kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation- Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot – Touch sensors-Tactile, Robot work cell design and control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT V MICRO/NANO ROBOTICS SYSTEM **9**

Micro/Nano robotics system overview-Scaling effect-Top down and bottom up approach Actuators of Micro/Nano robotics system-Nano robot communication techniques-Fabrication of micro/nano grippers-Wall climbing micro robot working principles-Biomimetic robot-Swarm robot-Nano robot in targeted drug delivery system.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Understand architecture and modeling of autonomous systems.

CO2: Employ localization mapping techniques for autonomous systems

CO3: Design solutions for autonomous systems control.

CO4: Analyze Robot Transformations, Sensors and Cell Design

CO5: Explain the working principles of Micro/Nano Robotic system

TOTAL: 45

REFERENCES

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education.,2009
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012.
3. Karsten Berns, Ewald Puttkamer, Springer, Autonomous Land Vehicles: Steps towards Service Robots, 2009
4. Sebastian Thrun, Wolfram Burgard, Dieter Fox., Probabilistic robotics. MIT Press, 2005
5. Steven M. LaValle., Planning algorithms, Cambridge University Press, 2006
6. Daniel Watzenig and Martin Horn (Eds.), Automated Driving: Safer and More Efficient Future Driving, Springer, 2017
7. Markus Maurer, Autonomous driving: technical, legal and social aspects. Springer, 2016
8. Jha, Theory, Design and Applications of Unmanned Aerial Vehicles, CRC Press, 2016

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	1	2	3	2	3	3
2	2	1	2	3	2	2
3	1	2	2	-	1	1
4	2	1	2	2	2	-
5	3	-	-	1	-	2
Avg	1.80	1.50	2.25	2.00	2.00	2.00

WEB ANALYTICS

Course Code	24CP913	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Web Technologies, Data Analysis, and Internet concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. To understand the Web analytics platform, and their evolution.
2. To learn about the various Data Streams Data.
3. To learn about the benefits of surveys and capturing of data
4. To understand Common metrics of web as well as KPI related concepts.
5. To learn about the various Web analytics versions.

UNIT I INTRODUCTION **9**

Definition, Process, Key terms: Site references, Keywords and Key phrases; building block terms: Visit characterization terms, Content characterization terms, Conversion metrics; Categories: Offsite web, on site web; Web analytics platform, Web analytics evolution, Need for web analytics, Advantages, Limitations.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II DATA COLLECTION **9**

Click stream Data: Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes Data: E-commerce, Lead generation, Brand/Advocacy and Support; Research data: Mindset, Organizational structure, Timing; Competitive Data: Panel-Based measurement, ISP-based measurement, Search Engine data.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III QUALITATIVE ANALYSIS 9

Heuristic evaluations: Conducting a heuristic evaluation, Benefits of heuristic evaluations; Site Visits: Conducting a site visit, Benefits of site visits; Surveys: Website surveys, Post-visit surveys, creating and running a survey, Benefits of surveys. Capturing data: Web logs or JavaScript's tags, Separate data serving and data capture, Type and size of data, Innovation, Integration, Selecting optimal web analytic tool, Understanding click stream data quality, Identifying unique page definition, Using cookies, Link coding issues.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV WEB METRICS 9

Common metrics: Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, New visits; Optimization (e-commerce, non e-commerce sites): Improving bounce rates, Optimizing adwords campaigns; Real time report, Audience report, Traffic source report, Custom campaigns, Content report, Google analytics, Introduction to KPI, characteristics, Need for KPI, Perspective of KPI, Uses of KPI. Relevant Technologies: Internet & TCP/IP, Client / Server Computing, HTTP (Hypertext Transfer Protocol), Server Log Files & Cookies, Web Bugs.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V WEB ANALYTICS 2.0 9

Web analytics 1.0, Limitations of web analytics 1.0, Introduction to analytic 2.0, Competitive intelligence analysis : CI data sources, Toolbar data, Panel data ,ISP data, Search engine data, Hybrid data, Website traffic analysis: Comparing long term traffic trends, Analyzing competitive site overlap and opportunities. Google Analytics: Brief introduction and working, Adwords, Benchmarking, Categories of traffic: Organic traffic, Paid traffic; Google website optimizer, Implementation technology, Limitations, Performance concerns, Privacy issues**.**

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL: 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES

Upon completion of this course, the students should be able to:

CO1: Understand the Web analytics platform, and their evolution.

CO2: Use the various Data Streams Data.

CO3: Know how the survey of capturing of data will benefit.

CO4: Understand Common metrics of web as well as KPI related concepts.

CO5: Apply various Web analytics versions in existence.

REFERENCES:

1. Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc.2nd ed, 2012.
2. Kaushik A., Web Analytics 2.0, The Art of Online Accountability and Science of Customer Centricity, Wiley Publishing, Inc. 1st ed, 2010.
3. Sterne J., Web Metrics: Proven methods for measuring web site success, John Wiley and Sons, 2002

CO-PO Mapping

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	3	-	3	2	3	2
2	2	2	3	1	1	1
3	3	-	3	2	2	2
4	1	2	3	1	1	1
5	2	-	3	2	2	1
Avg	2.20	2.00	3.00	1.60	1.80	1.40

COGNITIVE COMPUTING

Course Code	24CP914	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Artificial Intelligence, Machine Learning, and Programming concepts**.**

COURSE OBJECTIVES: To impart the knowledge of

1. To familiarize Use the Innovation Canvas to justify potentially successful products.
2. To learn various ways in which to develop a product idea.
3. To understand about how Big Data can play vital role in Cognitive Computing
4. To know about the business applications of Cognitive Computing
5. To get into all applications of Cognitive Computing

UNIT I FOUNDATION OF COGNITIVE COMPUTING 9

Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation, and visualization services

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II NATURAL LANGUAGE PROCESSING IN COGNITIVE SYSTEMS 9

UNIT III BIG DATA AND COGNITIVE COMPUTING 9

Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, using advanced analytics to create value, Impact of open source tools on advanced analytics

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT IV BUSINESS IMPLICATIONS OF COGNITIVE COMPUTING 9

Preparing for change ,advantages of new disruptive models , knowledge meaning to business, difference with a cognitive systems approach , meshing data together differently, using business knowledge to plan for the future , answering business questions in new ways , building business specific solutions , making cognitive computing a reality , cognitive application changing the market The process of building a cognitive application: Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT V APPLICATION OF COGNITIVE COMPUTING **9**

Building a cognitive health care application: Foundations of cognitive computing for healthcare, constituents in healthcare ecosystem, learning from patterns in healthcare Data, Building on a foundation of big data analytics, cognitive applications across the health care eco system, starting with a cognitive application for healthcare, using cognitive applications to improve health and wellness, using a cognitive application to enhance the electronic medical record Using cognitive application to improve clinical teaching

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Explain applications in Cognitive Computing.

CO2: Describe Natural language processor role in Cognitive computing.

CO3: Explain future directions of Cognitive Computing

CO4: Evaluate the process of taking a product to market

CO5: Comprehend the applications involved in this domain.

TOTAL: **45**

REFERENCES

1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, “Cognitive computing and Big DataAnalytics”, Wiley, 2015
2. Robert A. Wilson, Frank C. Keil, “The MIT Encyclopedia of the Cognitive Sciences”, The MITPress, 1999.
3. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, “Probabilistic Models of Cognition”, Second Edition, 2016, https://probmods.org/.

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	1	3	2	-	2	-
2	2	-	3	1	3	-
3	1	2	-	-	3	-
4	-	-	2	2	1	1
5	2	2	1	-	1	2
Avg	1.5	2.3	2	1.5	2	1.5

QUANTUM COMPUTING

Course Code	24CP915	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Mathematics, Classical Computing, and Quantum Mechanics concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. To introduce the building blocks of Quantum computers and highlight the paradigm change between conventional computing and quantum computing
2. To understand the Quantum state transformations and the algorithms
3. To understand entangled quantum subsystems and properties of entangled states
4. To explore the applications of quantum computing

UNIT I QUANTUM BUILDING BLOCKS 9

The Quantum Mechanics of Photon Polarization, Single-Qubit Quantum Systems, Quantum State Spaces, Entangled States, Multiple-Qubit Systems, Measurement of Multiple-Qubit States, EPR Paradox and Bell's Theorem, Bloch sphere

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II QUANTUM STATE TRANSFORMATIONS 9

Unitary Transformations, Quantum Gates, Unitary Transformations as Quantum Circuits, Reversible Classical Computations to Quantum Computations, Language for Quantum Implementations.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III QUANTUM ALGORITHMS 9

Computing with Superpositions, Quantum Subroutines, Quantum Fourier Transformations, Shor's Algorithm and Generalizations, Grover's Algorithm and Generalizations

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV ENTANGLED SUBSYSTEMS AND ROBUST QUANTUM COMPUTATION 9

Quantum Subsystems, Properties of Entangled States, Quantum Error Correction, Graph states and codes, CSS Codes, Stabilizer Codes, Fault Tolerance and Robust Quantum Computing

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT V QUANTUM INFORMATION PROCESSING 9

Limitations of Quantum Computing, Alternatives to the Circuit Model of Quantum Computation, Quantum Protocols, Building Quantum, Computers, Simulating Quantum Systems, Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

COURSE OUTCOMES:

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

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

CO1: Understand the basic principles of quantum computing.

CO2: Gain knowledge of the fundamental differences between conventional computing and quantum computing.

CO3: Understand several basic quantum computing algorithms.

CO4: Understand the classes of problems that can be expected to be solved well by quantum computers.

CO5: Simulate and analyze the characteristics of Quantum Computing Systems.

TOTAL: 45

REFERENCES:

1. John Gribbin, Computing with Quantum Cats: From Colossus to Qubits, 2021
2. William (Chuck) Easttom, Quantum Computing Fundamentals, 2021
3. Parag Lala, Quantum Computing, 2019
4. Eleanor Rieffel and Wolfgang Polak, QUANTUM COMPUTING A Gentle Introduction, 2011
5. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press.2002
6. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific. 2004
7. Pittenger A. O., An Introduction to Quantum Computing Algorithms 2000

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	1	2	3	-	1	-
2	1	2	3	-	2	-
3	-	1	3	2	3	2
4	2	-	2	2	1	3
5	3	-	1	2	3	3
Avg	1.75	1.7	2.4	2	2	2.73

BIG DATA MINING AND ANALYTICS

Course Code	24CP916	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Databases, Data Mining, Statistics, and Programming concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. To understand the computational approaches to Modeling, Feature Extraction
2. To understand the need and application of Map Reduce
3. To understand the various search algorithms applicable to Big Data
4. To analyze and interpret streaming data
5. To learn how to handle large data sets in main memory and learn the various clustering techniques applicable to Big Data

UNIT I DATA MINING AND LARGE SCALE FILES 9

Introduction to Statistical modeling – Machine Learning – Computational approaches to modeling – Summarization – Feature Extraction – Statistical Limits on Data Mining - Distributed File Systems – Map-reduce – Algorithms using Map Reduce – Efficiency of Cluster Computing Techniques.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II SIMILAR ITEMS 9

Nearest Neighbor Search – Shingling of Documents – Similarity preserving summaries – Locality sensitive hashing for documents – Distance Measures – Theory of Locality Sensitive Functions – LSH Families – Methods for High Degree of Similarities.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III MINING DATA STREAMS 9

Stream Data Model – Sampling Data in the Stream – Filtering Streams – Counting Distance Elements in a Stream – Estimating Moments – Counting Ones in Window – Decaying Windows.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV LINK ANALYSIS AND FREQUENT ITEMSETS 9

Page Rank –Efficient Computation - Topic Sensitive Page Rank – Link Spam – Market Basket Model – A-priori algorithm – Handling Larger Datasets in Main Memory – Limited Pass Algorithm – Counting Frequent Item sets.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V CLUSTERING 9

Introduction to Clustering Techniques – Hierarchical Clustering –Algorithms – K-Means – CURE – Clustering in Non -– Euclidean Spaces – Streams and Parallelism – Case Study: Advertising on the Web – Recommendation Systems.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL: 45

COURSE OUTCOMES:

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

Upon completion of this course, the students will be able to

CO1: Design algorithms by employing Map Reduce technique for solving Big Data problems.
CO2: Design algorithms for Big Data by deciding on the apt Features set .
CO3: Design algorithms for handling petabytes of datasets
CO4: Design algorithms and propose solutions for Big Data by optimizing main memory consumption
CO5: Design solutions for problems in Big Data by suggesting appropriate clustering techniques.

REFERENCES:

1. Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 3rd Edition, 2020.
2. Jiawei Han, MichelineKamber, Jian Pei, “Data Mining Concepts and Techniques”, Morgan Kaufman Publications, Third Edition, 2012.
3. Ian H.Witten, Eibe Frank “Data Mining – Practical Machine Learning Tools and Techniques”, Morgan Kaufman Publications, Third Edition, 2011.
4. David Hand, HeikkiMannila and Padhraic Smyth, “Principles of Data Mining”, MIT PRESS, 2001

WEB REFERENCES:

1. *https://swayam.gov.in/nd2_arp19_ap60/preview*
2. *https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106104189/lec1.pdf*

ONLINE RESOURCES:

1. *https://examupdates.in/big-data-analytics/*
2. *https://www.tutorialspoint.com/big_data_analytics/index.htm*
3. *https://www.tutorialspoint.com/data_mining/index.htm*

CO-PO Mapping

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	-	-	-	2	3	3
2	-	-	-	-	2	2
3	-	-	-	2	3	3
4	1	-	2	2	3	3
5	2	3	2	2	3	3
Avg	1.5	3	2	2	2.8	2.8

MOBILE AND PERVASIVE COMPUTING

Course Code	24CP917	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Computer Networks, Wireless Communication, and Operating Systems

COURSE OBJECTIVES: To impart the knowledge of

1. To understand the basics of Mobile Computing and Personal Computing
2. To learn the role of cellular networks in Mobile and Pervasive Computing
3. To expose to the concept of sensor and mesh networks
4. To expose to the context aware and wearable computing
5. To learn to develop applications in mobile and pervasive computing environment

UNIT I INTRODUCTION **9**

Differences between Mobile Communication and Mobile Computing – Contexts and Names – Functions – Applications and Services – New Applications – Making Legacy Applications Mobile Enabled – Design Considerations – Integration of Wireless and Wired Networks – Standards Bodies – Pervasive Computing – Basics and Vision – Principles of Pervasive Computing – Categories of Pervasive Devices

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II 3G AND 4G CELLULAR NETWORKS **9**

Migration to 3G Networks – IMT 2000 and UMTS – UMTS Architecture – User Equipment – Radio Network Subsystem – UTRAN – Node B – RNC functions – USIM – Protocol Stack – CS and PS Domains – IMS Architecture – Handover – 3.5G and 3.9G a brief discussion – 4G LAN and Cellular Networks – LTE – Control Plane – NAS and RRC – User Plane – PDCP, RLC and MAC – WiMax IEEE 802.16d/e – WiMax Internetworking with 3GPP

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V APPLICATION DEVELOPMENT **9**

Three tier architecture - Model View Controller Architecture - Memory Management – Information Access Devices – PDAs and Smart Phones – Smart Cards and Embedded Controls – J2ME – Programming for CLDC – GUI in MIDP – Application Development ON Android and iPhone

UNIT III SENSOR AND MESH NETWORKS **9**

Sensor Networks – Role in Pervasive Computing – In Network Processing and Data Dissemination – Sensor Databases – Data Management in Wireless Mobile Environments – Wireless Mesh Networks – Architecture – Mesh Routers – Mesh Clients – Routing – Cross Layer Approach – Security Aspects of Various Layers in WMN – Applications of Sensor and Mesh networks

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1, L3

Evaluation Methods: Performance in Suggested Activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Design a basic architecture for a pervasive computing environment

CO2: Design and build the wireless 3G/4G and wireless LAN networks

CO3: Analyze the role of sensors in Wireless networks

CO4: Work out the routing in mesh network

CO5: Deploy the location and context information for application development

CO6: Develop mobile computing applications based on the paradigm of context aware computing and wearable computing

UNIT IV CONTEXT AWARE COMPUTING & WEARABLE COMPUTING **9**

Adaptability – Mechanisms for Adaptation - Functionality and Data – Transcoding – Location Aware Computing – Location Representation – Localization Techniques – Triangulation and Scene Analysis – Delaunay Triangulation and Voronoi graphs – Types of Context – Role of Mobile Middleware – Adaptation and Agents – Service Discovery Middleware Health BAN- Medical and Technological Requirements-Wearable Sensors-Intra BAN communications

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3 **TOTAL** **45**

REFERENCES

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, “Mobile Computing: Technology, Applications and Service Creation”, 2nd ed, Tata McGraw Hill, 2017.
2. Reto Meier, “Professional Android 2 Application Development”, Wrox Wiley,2010.
3. Pei Zheng and Lionel M Li, ‘Smart Phone & Next Generation Mobile Computing’, Morgan Kaufmann Publishers, 2006.
4. Frank Adelstein, ‘Fundamentals of Mobile and Pervasive Computing’, TMH, 2005
5. Jochen Burthardt et al, ‘Pervasive Computing: Technology and Architecture of Mobile Internet Applications’, Pearson Education, 2003
6. Feng Zhao and Leonidas Guibas, ‘Wireless Sensor Networks’, Morgan Kaufmann Publishers, 2004
7. Uwe Hansmaan et al, ‘Principles of Mobile Computing’, Springer, 2nd edition,2006
8. Reto Meier, “Professional Android 2 Application Development”, Wrox Wiley,2010.
9. Mohammad s. Obaidat et al, “Pervasive Computing and Networking” ,John wiley, 2011
10. Stefan Poslad, “Ubiquitous Computing: Smart Devices, Environments and Interactions”, Wiley, 2009
11. Frank Adelstein Sandeep K. S. Gupta Golden G. Richard III Loren Schwiebert “Fundamentals of Mobile and Pervasive Computing, “, McGraw-Hill, 2005

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	3	3	1	3	1	3
2	2	2	2	2	2	2
3	1	3	1	1	2	2
4	1	2	2	2	1	1
5	2		2	1	2	2
Avg	1.80	2.50	1.60	1.80	1.60	2.00

WEB SERVICES AND API DESIGN

Course Code	24CP918	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Web Technologies, Databases, and Programming concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. To learn the basics of Web service.
2. To become familiar with the Web Services building blocks
3. To learn to work with RESTful web services.
4. To implement the RESTful web services.
5. To understand resource oriented Architecture

UNIT I INTRODUCTION TO WEB SERVICE 9

Overview – Web service-Architecture – Service-Oriented Architecture (SOA), Architecting Web Services: Web Services Technology Stack, Logical Architectural View, Deployment Architectural View, and Process Architectural View.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II WEB SERVICE BUILDING BLOCKS 9

Introduction to SOAP: SOAP Syntax- Sending SOAP Messages - SOAP Implementations - Introduction to WSDL: WSDL Syntax - SOAP Binding - WSDL Implementations - Introduction to UDDI: The UDDI API - Implementations - The Future of UDDI

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III RESTFUL WEB SERVICES 9

Programmable Web - HTTP: Documents in Envelopes - Method Information - Scoping Information - The Competing Architectures - Technologies on the Programmable Web -Leftover Terminology - Writing Web Service Clients: The Sample Application - Making the Request: HTTP Libraries - Processing the Response: XML Parsers - JSON Parsers: Handling Serialized Data - Clients Made Easy with WADL.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV IMPLEMENTATION OF RESTFUL WEB SERVICES 9

Introducing the Simple Storage Service - Object-Oriented Design of S3 - Resources - HTTP Response Codes Resource- URIs - Addressability - Statelessness - Representations - Links and Connectedness - The Uniform Interface – Spring Web Services – Spring MVC Components - Spring Web Flow - A Service Implementation using Spring Data REST.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V RESOURCE ORIENTED ARCHITECTURE 9

Resource- URIs - Addressability - Statelessness - Representations - Links and Connectedness - The Uniform Interface- Designing Read-Only Resource-Oriented Services : Resource Design - Turning Requirements Into Read-Only Resources - Figure Out the Data Set- Split the Data Set into Resources- Name the Resources - Design Representation- Link the Resources to Each Other- The HTTP Response

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Explain how to write XML documents.

CO2: Apply the web service building blocks such as SOAP, WSDL and UDDI

CO3: Describe the RESTful web services.

CO4: Implement the RESTful web service with Spring Boot MVC

CO5: Discuss Resource-oriented Architecture.

TOTAL: 45

REFERENCES

1. Leonard Richardson and Sam Ruby, RESTful Web Services, O'Reilly Media, 2007
2. McGovern, et al., "Java Web Services Architecture", Morgan Kaufmann Publishers,2005.
3. Lindsay Bassett, Introduction to JavaScript Object Notation, O'Reilly Media, 2015
4. Craig Walls, "Spring in Action, Fifth Edition", Manning Publications, 2018
5. Raja CSP Raman, Ludovic Dewailly, "Building A RESTful Web Service with Spring 5", Packt Publishing, 2018.
6. Bogunuva Mohanram Balachandar, "Restful Java Web Services, Third Edition: A pragmatic guide to designing and building RESTful APIs using Java", Ingram short title, 3rd Edition, 2017.
7. Mario-Leander Reimer, "Building RESTful Web Services with Java EE 8: Create modern RESTful web services with the Java EE 8 API", Packt publishing, 2018.

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	1	3	3	-	-	-
2	1	-	3	3	1	2
3	-	3	3	-	-	-
4	1	-	2	3	1	2
5	1	-	1	-	1	-
Avg	1	3	2.4	3	1	2

DATA VISUALIZATION TECHNIQUES

Course Code	24CP919	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Statistics, Data Analysis, and Programming concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. To develop skills to both design and critique visualizations.
2. To introduce visual perception and core skills for visual analysis.
3. To understand technological advancements of data visualization
4. To understand various data visualization techniques
5. To understand the methodologies used to visualize large data sets

UNIT I INTRODUCTION AND DATA FOUNDATION 9

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

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II FOUNDATIONS FOR VISUALIZATION 9

Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables – Historical Perspective - Taxonomies - Experimental Semiotics based on Perception Gibson‘s Affordance theory – A Model of Perceptual Processing.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III VISUALIZATION TECHNIQUES 9

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

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV INTERACTION CONCEPTS AND TECHNIQUES 9

Text and Document Visualization: Introduction - Levels of Text Representations - The Vector Space Model - Single Document Visualizations -Document Collection Visualizations – Extended Text Visualizations Interaction Concepts: Interaction Operators - Interaction Operands and Spaces
- A Unified Framework. Interaction Techniques: Screen Space - Object-Space –Data Space - Attribute Space- Data Structure Space - Visualization Structure – Animating Transformations - Interaction Control.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V RESEARCH DIRECTIONS IN VISUALIZATIONS 9

Steps in designing Visualizations – Problems in designing effective Visualizations- Issues of Data. Issues of Cognition, Perception, and Reasoning. Issues of System Design Evaluation , Hardware and Applications

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Visualize the objects in different dimensions.

CO2: Design and process the data for Visualization.

CO3: Apply the visualization techniques in physical sciences, computer science, applied mathematics and medical sciences.

CO4: Apply the virtualization techniques for research projects.

CO5: Identify appropriate data visualization techniques given particular requirements imposed by the data.

TOTAL: 45

REFERENCES

1. Matthew Ward, Georges Grinstein and Daniel Keim, "Interactive Data Visualization Foundations, Techniques, Applications", 2010.
2. Colin Ware, "Information Visualization Perception for Design", 4th edition, Morgan Kaufmann Publishers, 2021.
3. Robert Spence "Information visualization – Design for interaction", Pearson Education, 2nd Edition, 2007.
4 Alexandru C. Telea, "Data Visualization: Principles and Practice," A. K. Peters Ltd, 2008.

CO-PO Mapping

CO	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	3	1	2	2	1	2
2	2	1	2	3	2	2
3	1	-	2	2	1	1
4	3	1	3	3	2	2
5	2	1	3	2	1	1
Avg	2.20	1.00	2.40	2.40	1.40	1.60

COMPILER OPTIMIZATION TECHNIQUES

Course Code	24CP920	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Compiler Design, Data Structures, and Programming Language concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. To understand the optimization techniques used in compiler design.
2. To be aware of the various computer architectures that support parallelism.
3. To become familiar with the theoretical background needed for code optimization.
4. To understand the techniques used for identifying parallelism in a sequential program.
5. To learn the various optimization algorithms.

UNIT I INTRODUCTION **9**

Language Processors - The Structure of a Compiler – The Evolution of Programming Languages- The Science of Building a Compiler – Applications of Compiler Technology Programming Language Basics - The Lexical Analyzer Generator -Parser Generator - Overview of Basic Blocks and Flow Graphs - Optimization of Basic Blocks - Principle Sources of Optimization.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II INSTRUCTION-LEVEL PARALLELISM **9**

Processor Architectures – Code-Scheduling Constraints – Basic-Block Scheduling –Global Code Scheduling – Advanced code motion techniques – Interaction with Dynamic Schedulers- Software Pipelining.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III OPTIMISING FOR PARALLELISM AND LOCALITY-THEORY **9**

Basic Concepts – Matrix-Multiply: An Example - Iteration Spaces - Affine Array Indexes – Data Reuse- Array data dependence Analysis.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV OPTIMISING FOR PARALLELISM AND LOCALITY – APPLICATION **9**

Finding Synchronisation - Free Parallelism – Synchronisation Between Parallel Loops – Pipelining – Locality Optimizations – Other Uses of Affine Transforms.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V INTERPROCEDURAL ANALYSIS **9**

Simple Pointer-Analysis Algorithm – Context Insensitive Interprocedural Analysis - Context-Sensitive Pointer-Analysis - Datalog Implementation by Binary Decision Diagrams.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Design and implement techniques used for optimization by a compiler.
CO2: Modify the existing architecture that supports parallelism.
CO3: Modify the existing data structures of an open source optimising compiler.
CO4: Design and implement new data structures and algorithms for code optimization.
CO5: Critically analyse different data structures and algorithms used in the building of an optimising compiler.

TOTAL : 45

REFERENCES

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, “Compilers:Principles, Techniques and Tools”, Second Edition, Pearson Education,2008.
2. Randy Allen, Ken Kennedy, “Optimizing Compilers for Moder Architectures: A Dependence-based Approach”, Morgan Kaufmann Publishers, 2002
3. Steven S. Muchnick, “Advanced Compiler Design and Implementation”,Morgan Kaufmann
4. Publishers - Elsevier Science, India, 2007
5. John Hopcroft, Rajeev Motwani, Jeffrey Ullman, “Introduction To Automata Theory
6. Languages, and Computation”, Third Edition, Pearson Education, 2007.
7. Torbengidius Mogensen, “Basics of Compiler Design”, Springer, 2011.
8. Charles N, Ron K Cytron, Richard J LeBlanc Jr., “Crafting a Compiler”, Pearson Education, 2010.

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	2	2	2	3	2	2
2	-	-	3	3	-	3
3	3	-	3	3	-	3
4	3	3	3	3	-	-
5	-	3	3	3	3	-
Avg	2.6	2.6	2.8	3	2.5	2.6

FORMAL MODELS OF SOFTWARE SYSTEMS

Course Code	24CP921	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Discrete Mathematics, Automata Theory, and Software Engineering concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. To understand the goals, complexity of software systems, the role of Specification activities and qualities to control complexity.
2. To understand the fundamentals of abstraction and formal systems
3. To learn fundamentals of logic reasoning- Propositional Logic, temporal logic and apply to models systems
4. To understand formal specification models based on set theory, calculus and algebra and apply to a case study
5. To learn Z, Object Z and B Specification languages with case studies.

UNIT I SPECIFICATION FUNDAMENTALS 9

Role of Specification- Software Complexity - Size, Structural, Environmental, Application, domain, Communication Complexity, How to Control Complexity. Software specification, Specification Activities-Integrating Formal Methods into the Software Lifecycle. Specification Qualities- Process Quality Attributes of Formal Specification Languages, Model of Process Quality, Product Quality and Utility, Conformance to Stated Goals Quality Dimensions and Quality Model.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II FORMAL METHODS 9

Abstraction- Fundamental Abstractions in Computing. Abstractions for Software Construction. Formalism Fundamentals - Formal Systems, Formalization Process in Software Engineering Components of a Formal System- Syntax, Semantics, and Inference Mechanism. Properties of Formal Systems - Consistency. Automata-Deterministic Finite Accepters, State Machine Modeling Nondeterministic Finite Accepters, Finite State Transducers Extended Finite State Machine. Case Study—Elevator Control. Classification of C Methods-Property-Oriented Specification Methods, Model-Based Specification Techniques.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III LOGIC **9**

Propositional Logic - Reasoning Based on Adopting a Premise, Inference Based on Natural Deduction. Predicate Logic - Syntax and Semantics, Policy Language Specification, knowledge Representation Axiomatic Specification. Temporal Logic -. Temporal Logic for Specification and Verification, Temporal Abstraction Propositional Temporal Logic (PTL), First Order Temporal Logic (FOTL). Formal Verification, Verification of Simple FOTL, Model Checking, Program Graphs, Transition Systems.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV SPECIFICATION MODELS **9**

Mathematical Abstractions for Model-Based Specifications-Formal Specification Based on Set Theory, Relations and Functions. Property-Oriented Specifications- Algebraic Specification, Properties of Algebraic Specifications, Reasoning, Structured Specifications. Case Study—A Multiple Window Environment: requirements, Modeling Formal Specifications. Calculus of Communicating Systems: Specific Calculus for Concurrency. Operational Semantics of Agents, Simulation and Equivalence, Derivation Trees, Labeled Transition Systems.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V FORMAL LANGUAGES **9**

The Z Notation, abstractions in Z, Representational Abstraction, Types, Relations and Functions, Sequences, Bags. Free Types-Schemas, Operational Abstraction -Operations Schema Decorators, Generic Functions, Proving Properties from Z specifications, Consistency of Operations. Additional Features in Z. Case Study: An Automated Billing System. The Object-Z Specification Language-Basic Structure of an Object-Z, Specification. Parameterized Class, Object-Orientation, composition of Operations-Parallel Communication Operator, Nondeterministic Choice Operator, and Environment Enrichment. The B-Method -Abstract Machine Notation (AMN), Structure of a B Specification, arrays, statements. Structured Specifications, Case Study- A Ticketing System in a Parking.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**
Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:
CO1: Understand the complexity of software systems, the need for formal specifications activities and qualities to control complexity.
CO2: Gain knowledge on fundamentals of abstraction and formal systems
CO3: Learn the fundamentals of logic reasoning- Propositional Logic, temporal logic and apply to models systems
CO4: Develop formal specification models based on set theory, calculus and algebra and apply to a typical case study
CO5: Have working knowledge on Z, Object Z and B Specification languages with case studies.

TOTAL: 45

REFERENCES

1. Mathematical Logic for computer science ,second edition, M.Ben-Ari ,Springer,2012.
2. Logic in Computer Science- modeling and reasoning about systems, 2 nd Edition, Cambridge University Press, 2004.
3. Specification of Software Systems, V.S. Alagar, K. Periyasamy, David Grises and Fred B Schneider, Springer –Verlag London, 2011
4. The ways Z: Practical programming with formal methods, Jonathan Jacky, Cambridge University Press,1996.
5. Using Z-Specification Refinement and Proof,Jim Woodcock and Jim Devies Prentice Hall, 1996
6. Markus Roggenbach ,Antonio Cerone, Bernd-Holger Schlingloff, Gerardo Schneider , Siraj Ahmed Shaikh, Formal Methods for Software Engineering: Languages, Methods, Application Domains (Texts in Theoretical Computer Science. An EATCS Series) 1st ed. 2022 Edition

CO-PO Mapping

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	1	1	3	-	2	3
2	2	1	-	2	1	3
3	3	1	2	3	2	3
4	-	2	2	-	1	3
5	2	2	-	3	3	3
Avg	2.00	1.40	2.33	2.67	1.80	3.00

ROBOTICS

Course Code	24CP922	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of mathematics, programming fundamentals, sensors, and control systems.

COURSE OBJECTIVES: To impart the knowledge of

1. To Introduce the concepts of Robotic systems
2. To understand the concepts of Instrumentation and control related to Robotics
3. To understand the kinematics and dynamics of robotics
4. To explore robotics in Industrial applications

UNIT I INTRODUCTION TO ROBOTICS 9

Robotics -History - Classification and Structure of Robotic Systems - Basic components -Degrees of freedom - Robot joints coordinates- Reference frames - workspace- Robot languages- Robotic sensors- proximity and range sensors, ultrasonic sensor, touch and slip sensor.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II ROBOT KINEMATICS AND DYNAMICS 9

Kinematic Modelling: Translation and Rotation Representation, Coordinate transformation, DH parameters, Forward and inverse kinematics, Jacobian, Dynamic Modelling: Forward and inverse dynamics, Equations of motion using Euler-Lagrange formulation, Newton Euler formulation.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III ROBOTICS CONTROL 9

Control of robot manipulator - state equations - constant solutions -linear feedback systems, single-axis PID control - PD gravity control -computed torque control, variable structure control and impedance control.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV ROBOT INTELLIGENCE AND TASK PLANNING 9

Artificial Intelligence - techniques - search problem reduction - predicate logic means and end analysis -problem solving -robot learning - task planning - basic problems in task planning - AI in robotics and Knowledge Based Expert System in robotics

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V INDUSTRIAL ROBOTICS 9

Robot cell design and control - cell layouts - multiple robots and machine interference - work cell design - work cell control - interlocks – error detection deduction and recovery - work cell controller - robot cycle time analysis. Safety in robotics, Applications of robot and future scope.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

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

CO1: Describe the fundamentals of robotics

CO2: Understand the concept of kinematics and dynamics in robotics.

CO3: Discuss the robot control techniques

CO4: Explain the basis of intelligence in robotics and task planning

CO5: Discuss the industrial applications of robotics

TOTAL: 45

REFERENCE:

1. John J. Craig, 'Introduction to Robotics (Mechanics and Control)', Addison-Wesley, 2nd Edition, 2004.
2. Richard D. Klafter, Thomas A. Chmielewski, Michael Negin, 'Robotics Engineering: An Integrated Approach', PHI Learning, New Delhi, 2009.
3. K.S.Fu, R.C.Gonzalez and C.S.G.Lee, 'Robotics Control, Sensing, Vision and Intelligence', Tata McGraw Hill, 2nd Reprint,2008.
4. Reza N.Jazar, 'Theory of Applied Robotics Kinematics, Dynamics and Control', Springer, 1st Indian Reprint, 2010.
5. Mikell. P. Groover, Michell Weis, Roger. N. Nagel, Nicolous G.Odrey, 'Industrial Robotics Technology, Programming and Applications ', McGraw Hill, Int 2012.

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	1	3	3	-	2	-
2	1	2	3	2	1	1
3	1	2	-	3	3	2
4	2	-	3	-	2	-
5	1	-	-	3	3	3
Avg	1.2	2.3	3	2.7	2.2	2

NATURAL LANGUAGE PROCESSING

Course Code	24CP923	Course Type		INTEGRATED	
Course Offered to	ME-CSE				
Total Teaching Periods	60	L:T:P	2:0:2	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				50 Marks	50 Marks

Prerequisite: Basic knowledge of programming, data structures, probability, and machine learning concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. To understand basics of linguistics, probability and statistics
2. To study statistical approaches to NLP and understand sequence labeling
3. To outline different parsing techniques associated with NLP
4. To explore semantics of words and semantic role labeling of sentences
5. To understand discourse analysis, question answering and chatbots

UNIT I INTRODUCTION **6**

Natural Language Processing – Components - Basics of Linguistics and Probability and Statistics – Words-Tokenization-Morphology-Finite State Automata

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT II STATISTICAL NLP AND SEQUENCE LABELING **6**

N-grams and Language models –Smoothing -Text classification- Naïve Bayes classifier – Evaluation - Vector Semantics – TF-IDF - Word2Vec- Evaluating Vector Models -Sequence Labeling – Part of Speech – Part of Speech Tagging -Named Entities –Named Entity Tagging

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT III CONTEXTUAL EMBEDDING **6**

Constituency –Context Free Grammar –Lexicalized Grammars- CKY Parsing – Earley's algorithm- Evaluating Parsers -Partial Parsing – Dependency Relations- Dependency Parsing - Transition Based - Graph Based

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT IV COMPUTATIONAL SEMANTICS **6**

Word Senses and WordNet – Word Sense Disambiguation – Semantic Role Labeling –Proposition Bank- FrameNet- Selectional Restrictions - Information Extraction - Template Filling

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L4

UNIT V DISCOURSE ANALYSIS AND SPEEC PROCESSING **6**

Discourse Coherence – Discourse Structure Parsing – Centering and Entity Based Coherence –Question Answering –Factoid Question Answering – Classical QA Models – Chatbots and Dialogue systems – Frame-based Dialogue Systems – Dialogue–State Architecture

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L4

TOTAL : 30

SUGGESTED ACTIVITIES:

1. Probability and Statistics for NLP Problems
2. Carry out Morphological Tagging and Part-of-Speech Tagging for a sample text
3. Design a Finite State Automata for more Grammatical Categories
4. Problems associated with Vector Space Model
5. Hand Simulate the working of a HMM model
6. Examples for different types of work sense disambiguation
7. Give the design of a Chatbot

PRACTICALS: **PERIODS : 30**

1. Download nltk and packages. Use it to print the tokens in a document and the sentences from it.
2. Include custom stop words and remove them and all stop words from a given document using nltk or spaCY package
3. Implement a stemmer and a lemmatizer program.
4. Implement a simple Part-of-Speech Tagger
5. Write a program to calculate TFIDF of documents and find the cosine similarity between any two documents.
6. Use nltk to implement a dependency parser.
7. Implement a semantic language processor that uses WordNet for semantic tagging.
8. Project - (in Pairs) Your project must use NLP concepts and apply them to some data.
    a. Your project may be a comparison of several existing systems, or it may propose a new system in which case you still must compare it to at least one other approach.
    b. You are free to use any third-party ideas or code that you wish as long as it is publicly available.
    c. You must properly provide references to any work that is not your own in the write- up.
    d. Project proposal You must turn in a brief project proposal. Your project proposal should describe the idea behind your project. You should also briefly describe software you will need to write, and papers (2-3) you plan to read.

List of Possible Projects

1. Sentiment Analysis of Product Reviews
2. Information extraction from News articles
3. Customer support bot
4. Language identifier
5. Media Monitor
6. Paraphrase Detector
7. Identification of Toxic Comment
8. Spam Mail Identification

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Understand basics of linguistics, probability and statistics associated with NLP

CO2: Implement a Part-of-Speech Tagger

CO3: Design and implement a sequence labeling problem for a given domain

CO4: Implement semantic processing tasks and simple document indexing and searching system using the concepts of NLP

CO5:: Implement a simple chatbot using dialogue system concepts

TOTAL : 60

REFERENCES

1. Daniel Jurafsky and James H.Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition" (Prentice Hall Series in Artificial Intelligence), 2020
2. Jacob Eisenstein. "Natural Language Processing ", MIT Press, 2019
3. Samuel Burns "Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019
4. Christopher Manning, "Foundations of Statistical Natural Language Processing", MIT Press, 2009.
5. Nitin Indurkhya,Fred J. Damerau, "Handbook of Natural Language Processing", Second edition, Chapman & Hall/CRC: Machine Learning & Pattern Recognition, Hardcover,2010
6. Deepti Chopra, Nisheeth Joshi, "Mastering Natural Language Processing with Python", Packt Publishing Limited, 2016
7. Mohamed Zakaria Kurdi "Natural Language Processing and Computational Linguistics: Speech, Morphology and Syntax (Cognitive Science)", ISTE Ltd., 2016
8. Atefeh Farzindar,Diana Inkpen, "Natural Language Processing for Social Media (Synthesis Lectures on Human Language Technologies)", Morgan and Claypool Life Sciences, 2015

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	-	2	3	1	1	-
2	2	2	2	3	-	3
3	3	-	3	3	-	3
4	1	-	2	3	-	3
5	1	-	2	3	-	3
Avg	1.75	2	2.4	2.6	1	3

GPU COMPUTING

Course Code	24CP924	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of C/C++ programming, computer architecture, parallel computing concepts, and operating systems.

COURSE OBJECTIVES: To impart the knowledge of

1. To understand the basics of GPU architectures
2. To understand CPU GPU Program Partitioning
3. To write programs for massively parallel processors
4. To understand the issues in mapping algorithms for GPUs
5. To introduce different GPU programming models

UNIT I GPU ARCHITECTURE 9

Evolution of GPU architectures - Understanding Parallelism with GPU –Typical GPU Architecture - CUDA Hardware Overview - Threads, Blocks, Grids, Warps, Scheduling - Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II CUDA PROGRAMMING 9

Using CUDA - Multi GPU - Multi GPU Solutions - Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III PROGRAMMING ISSUES 9

Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV OPENCL BASICS 9

OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model– Basic OpenCL Examples.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V ALGORITHMS ON GPU 9

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix - Matrix Multiplication - Programming Heterogeneous Cluster.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

SUGGESTED ACTIVITIES:

1. Debugging Lab
2. Performance Lab
3. Launching Nsight
4. Running Performance Analysis
5. Understanding Metrics
6. NVIDIA Visual Profiler
7. Matrix Transpose Optimization
8. Reduction Optimization

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Describe GPU Architecture
CO2: Write programs using CUDA, identify issues and debug them
CO3: Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication
CO4: Write simple programs using OpenCL
CO5: Identify efficient parallel programming patterns to solve problems

TOTAL: 45

REFERENCES

1. Shane Cook, CUDA Programming: “A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012.
2. David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, “Heterogeneous computing with OpenCL, 3rd Edition, Morgan Kauffman, 2015.
3. Nicholas Wilt, “CUDA Handbook: A Comprehensive Guide to GPU Programming, Addison - Wesley, 2013.
4. Jason Sanders, Edward Kandrot, “CUDA by Example: An Introduction to General Purpose GPU Programming, Addison - Wesley, 2010.
5. David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors - A Hands-on Approach, Third Edition, Morgan Kaufmann, 2016.

WEB LINKS:

6. http://www.nvidia.com/object/cuda_home_new.html
7. http://www.openCL.org

CO-PO Mapping

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	3	-	-	-	-	-
2	-	-	2	-	-	-
3	-	-	3	-	3	3
4	-	2	-	3	2	-
5	-	-	-	2	-	3
Avg	3	2	2.5	2.5	2.5	3

Course Code	24CP925	Course Type		INTEGRATED	
Course Offered to	ME-CSE				
Total Teaching Periods	75	L:T:P	3:0:2	Credits	4
Handled by	CSE	Assessment Methods		IAT 40 Marks	ESE 60 Marks

Prerequisite: Basic knowledge of software development, operating systems, networking, cloud computing, and web technologies.

COURSE OBJECTIVES: To impart the knowledge of

1. To learn the basic concepts and terminology of DevOps
2. To gain knowledge on Devops platform
3. To understand building and deployment of code
4. To be familiar with DevOps automation tools
5. To learn basics of MLOps

UNIT I INTRODUCTION **9+6**

Software Engineering - traditional and Agile process models - DevOps -Definition - Practices - DevOps life cycle process - need for DevOps –Barriers

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT II DEVOPS PLATFORM AND SERVICES **9+6**

Cloud as a platform - IaaS, PaaS, SaaS - Virtualization - Containers –Supporting Multiple Data Centers - Operation Services - Hardware provisioning- software Provisioning - IT services - SLA - capacity planning - security - Service Transition - Service Operation Concepts.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT III BUILDING , TESTING AND DEPLOYMENT **9+6**

Microservices architecture - coordination model - building and testing - Deployment pipeline - Development and Pre-commit Testing -Build and Integration Testing - continuous integration - monitoring - security - Resources to Be Protected - Identity Management

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT IV DEVOPS AUTOMATION TOOLS 9+6

Infrastructure Automation- Configuration Management - Deployment Automation - Performance Management - Log Management -Monitoring.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT V MLOPS 9+6

MLOps - Definition - Challenges -Developing Models - Deploying to production - Model Governance - Real world examples

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

SUGGESTED ACTIVITIES:

1. Creating a new Git repository, cloning existing repository, Checking changes into a Git repository, Pushing changes to a Git remote, Creating a Git branch
2. Installing Docker container on windows/Linux, issuing docker commands
3. Building Docker Images for Python Application
4. Setting up Docker and Maven in Jenkins and First Pipeline Run
5. Running Unit Tests and Integration Tests in Jenkins Pipelines

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Implement modern software Engineering process

CO2: work with DevOps platform

CO3: build, test and deploy code

CO4: Explore DevOps tools

CO5: Correlate MLOps concepts with real time examples

TOTAL: 75

REFERENCES

1. Len Bass, Ingo Weber and Liming Zhu, —"DevOps: A Software Architect's Perspective", Pearson Education, 2016
2. Joakim Verona - "Practical DevOps" - Packet Publishing , 2016
3. Viktor Farcic -"The DevOps 2.1 Toolkit: Docker Swarm" - Packet Publishing, 2017
4. Mark Treveil, and the Dataiku Team-"Introducing MLOps" - O'Reilly Media- 2020

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	3	2	1	2	3	-
2	3	2	-	--	3	-
3	3	2	2	3	2	3
4	3	2	1	2	3	-
5	3	2	2	1	2	3
Avg	3	2	1.5	2	2.6	3

MOBILE APPLICATION DEVELOPMENT

Course Code	24CP926	Course Type		INTEGRATED	
Course Offered to	ME-CSE				
Total Teaching Periods	75	L:T:P	3:0:2	Credits	4
Handled by	CSE	Assessment Methods		IAT	ESE
				50 Marks	50 Marks

Prerequisite: Basic knowledge of programming, object-oriented concepts, databases, and web technologies.

COURSE OBJECTIVES: To impart the knowledge of

1. To facilitate students to understand android SDK
2. To help students to gain basic understanding of Android application development
3. To understand how to work with various mobile application development frameworks
4. To inculcate working knowledge of Android Studio development tool
5. To learn the basic and important design concepts and issues of development of mobile applications

UNIT I MOBILE PLATFORM AND APPLICATIONS 9

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

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT II INTRODUCTION TO ANDROID 9

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT III ANDROID APPLICATION DESIGN ESSENTIALS 9

Anatomy of Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT IV ANDROID USER INTERFACE DESIGN & MULTIMEDIA 9

User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT V ANDROID APIs **9**

Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

LIST OF EXPERIMENTS: **(30)**

1. Develop an application that uses GUI components, Font, Layout Managers and event listeners.
2. Develop an application that makes use of databases
3. Develop a native application that uses GPS location information
4. Implement an application that creates an alert upon receiving a message
5. Develop an application that makes use of RSS Feed.
6. Create an application using Sensor Manager
7. Create an android application that converts the user input text to voice.
8. Develop a Mobile application for simple and day to day needs (Mini Project)

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Identify various concepts of mobile programming that make it unique from programming for other platforms

CO2: Create, test and debug Android application by setting up Android development

CO3: Demonstrate methods in storing, sharing and retrieving data in Android applications

CO4: Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces

CO5: Create interactive applications in android using databases with multiple activities including audio, video and notifications and deploy them in marketplace

TOTAL: **75**

REFERENCES

1. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2nd ed. (2011)
2. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference”, Google Developer Training Team, 2017.
3. Prasanth Kumar Pattnaik,Rajib Mall,”Fundamentals of Mobile Computing”,PHI Learning Pvt.Ltd,New Delhi-2012
4. Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd, 2010
5. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd, 2009
6. Dawn Griffiths and David Griffiths, “Head First Android Development”, 1st Edition, O"Reilly SPD Publishers, 2015. ISBN-13: 978-9352131341
7. Erik Hellman, “Android Programming – Pushing the Limits”, 1st Edition, Wiley India Pvt Ltd, 2014. ISBN-13: 978-8126547197.
8. Bill Phillips, Chris Stewart and Kristin Marsicano, “Android Programming: The Big Nerd Ranch Guide”, 4th Edition, Big Nerd Ranch Guides, 2019. ISBN-13: 978-0134706054

CO-PO Mapping

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	3	2	-	3	3	-
2	3	1	1	3	-	2
3	3	2	3	3	3	1
4	3	1	1	2	-	3
5	3	2	2	3	3	3
Avg	3	1.6	1.75	2.8	3	2.25

DEEP LEARNING

Course Code	24CP927	Course Type		INTEGRATED	
Course Offered to	ME-CSE				
Total Teaching Periods	75	L:T:P	3:0:2	Credits	4
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of programming, linear algebra, probability, statistics, and machine learning concepts.

COURSE OBJECTIVES: To impart the knowledge of

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

UNIT I DEEP LEARNING CONCEPTS **6**

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. Video Data.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT II NEURAL NETWORKS **9**

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.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT III CONVOLUTIONAL NEURAL NETWORK **10**

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. Backpropagation 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 VGG Model, Google Inception Model, Microsoft ResNet Model. R- CNN, Fast R-CNN, Faster R-CNN, Mask-RCNN, YOLO

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT VI NATURAL LANGUAGE PROCESSING USING RNN **10**

About NLP & its Toolkits. Language Modeling . Vector Space Model (VSM). Continuous Bag of Words (CBOW). Skip-Gram Model for Word Embedding. Part of Speech (PoS) Global Co- occurrence Statistics–based Word Vectors. Transfer Learning. Word2Vec. Global Vectors for Word Representation GloVe. Backpropagation Through Time. Bidirectional RNNs (BRNN) . Long Short Term Memory (LSTM). Bi-directional LSTM. Sequence-to-Sequence Models (Seq2Seq). Gated recurrent unit GRU.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT V DEEP REINFORCEMENT & UNSUPERVISED LEARNING **10**

About Deep Reinforcement Learning. Q-Learning. Deep Q-Network (DQN). Policy Gradient Methods. Actor-Critic Algorithm. About Autoencoding. Convolutional Auto Encoding. Variational Auto Encoding. Generative Adversarial Networks. Autoencoders for Feature Extraction. Auto Encoders for Classification. Denoising Autoencoders. Sparse Autoencoders

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

LIST OF EXPERIMENTS: **30**

1. Feature Selection from Video and Image Data
2. Image and video recognition
3. Image Colorization
4. Aspect Oriented Topic Detection & Sentiment Analysis
5. Object Detection using Autoencoder

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Feature Extraction from Image and Video Data

CO2: Implement Image Segmentation and Instance Segmentation in Images

CO3: Implement image recognition and image classification using a pretrained network (Transfer Learning)

CO4: Traffic Information analysis using Twitter Data

CO5: Autoencoder for Classification & Feature Extraction

TOTAL : 75

REFERENCES

1. Deep Learning A Practitioner's Approach Josh Patterson and Adam Gibson O'Reilly Media, Inc.2017
2. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
3. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
4. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017
5. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017

CO-PO Mapping

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	2	2	-	3	3	3
2	2	2	2	3	3	2
3	2	2	2	3	2	3
4	2	2	1	3	3	3
5	2	2	-	3	2	2
Avg	2	2	1.6	3	2.6	2.6

BLOCKCHAIN TECHNOLOGIES

Course Code	24CP928	Course Type		INTEGRATED	
Course Offered to	ME-CSE				
Total Teaching Periods	75	L:T:P	3:0:2	Credits	4
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of computer networks, cryptography, distributed systems, and programming fundamentals.

COURSE OBJECTIVES: To impart the knowledge of

1. This course is intended to study the basics of Blockchain technology.
2. During this course the learner will explore various aspects of Blockchain technology like application in various domains.
3. By implementing, learners will have idea about private and public Blockchain, and smart contract.

UNIT I INTRODUCTION OF CRYPTOGRAPHY AND BLOCKCHAIN 9

Introduction to Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions and Blocks, P2P Systems, Keys as Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT II BITCOIN AND CRYPTOCURRENCY 9

Introduction to Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double-Spend Problem, Blockchain and Digital Currency, Transactional Blocks, Impact of Blockchain Technology on Cryptocurrency.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT III INTRODUCTION TO ETHEREUM 9

Introduction to Ethereum, Consensus Mechanisms, Metamask Setup, Ethereum Accounts, , Transactions, Receiving Ethers, Smart Contracts.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT-IV INTRODUCTION TO HYPERLEDGER AND SOLIDITY PROGRAMMING 10

Introduction to Hyperledger, Distributed Ledger Technology & its Challenges, Hyperledger & Distributed Ledger Technology, Hyperledger Fabric, Hyperledger Composer. Solidity - Language of Smart Contracts, Installing Solidity & Ethereum Wallet, Basics of Solidity, Layout of a Solidity Source File & Structure of Smart Contracts, General Value Types.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT V BLOCKCHAIN APPLICATIONS 8

Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain, Alt Coins.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

TOTAL: 45

LIST OF EXPERIMENTS:

1. Create a Simple Blockchain in any suitable programming language.
2. Use Geth to Implement Private Ethereum Block Chain.
3. Build Hyperledger Fabric Client Application.
4. Build Hyperledger Fabric with Smart Contract.
5. Create Case study of Block Chain being used in illegal activities in real world.
6. Using Python Libraries to develop Block Chain Application.

TOTAL: 30

SUPPLEMENTARY RESOURCES:

- NPTEL online course : https://nptel.ac.in/courses/106/104/106104220/#
- Udemy: https://www.udemy.com/course/build-your-blockchain-az/
- EDUXLABS Online training :https://eduxlabs.com/courses/blockchain-technology- training/?tab=tab-curriculum

TOTAL: 75

COURSE OUTCOMES:

After the completion of this course, student will be able to

CO1: Understand and explore the working of Blockchain technology

CO2: Analyze the working of Smart Contracts

CO3: Understand and analyze the working of Hyperledger

CO4: Apply the learning of solidity to build de-centralized apps on Ethereum

CO5: Develop applications on Blockchain

REFERENCES:

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained", Second Edition, Packt Publishing, 2018.
2. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction" Princeton University Press, 2016
3. Antonopoulos, Mastering Bitcoin, O'Reilly Publishing, 2014. .
4. Antonopoulos and G. Wood, "Mastering Ethereum: Building Smart Contracts and Dapps", O'Reilly Publishing, 2018.
5. D. Drescher, Blockchain Basics. Apress, 2017.

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	2	1	3	2	2	3
2	2	1	2	3	2	2
3	2	1	3	1	2	1
4	2	1	2	3	2	2
5	-	-	-	-	-	-
Avg	2.00	1.00	2.50	2.25	2.00	2.00

EMBEDDED SOFTWARE DEVELOPMENT

Course Code	24CP929	Course Type		INTEGRATED	
Course Offered to	ME-CSE				
Total Teaching Periods	75	L:T:P	3:0:2	Credits	4
Handled by	CSE	Assessment Methods		IAT	ESE
				50 Marks	50 Marks

Prerequisite: Basic knowledge of C programming, microprocessors, microcontrollers, digital electronics, and operating systems.

COURSE OBJECTIVES: To impart the knowledge of

1. To understand the architecture of embedded processor, microcontroller, and peripheral devices.
2. To interface memory and peripherals with embedded systems.
3. To study the embedded network environment.
4. To understand challenges in Real time operating systems.
5. To study, analyse and design applications on embedded systems.

UNIT I EMBEDDED PROCESSORS 9+6

Embedded Computers – Characteristics of Embedded Computing Applications – Challenges in Embedded Computing System Design – Embedded System Design Process- Formalism for System Design – Structural Description – Behavioural Description – ARM Processor – Intel ATOM Processor.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L4

UNIT II EMBEDDED COMPUTING PLATFORM 9+6

CPU Bus Configuration – Memory Devices and Interfacing – Input/Output Devices and Interfacing – System Design – Development and Debugging – Emulator – Simulator – JTAG Design Example – Alarm Clock – Analysis and Optimization of Performance – Power and Program Size.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L

UNIT III EMBEDDED NETWORK ENIVIRONMENT 9+6

Distributed Embedded Architecture – Hardware And Software Architectures – Networks for Embedded Systems – I2C – CAN Bus – SHARC Link Supports – Ethernet – Myrinet – Internet – Network-based Design – Communication Analysis – System Performance Analysis – Hardware Platform Design – Allocation and Scheduling – Design Example – Elevator Controller.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L4

UNIT IV REAL-TIME CHARACTERISTICS 9+6

Clock Driven Approach – Weighted Round Robin Approach – Priority Driven Approach – Dynamic versus Static Systems – Effective Release Times and Deadlines – Optimality of the Earliest Deadline First (EDF) Algorithm – Challenges in Validating Timing Constraints in Priority Driven Systems – Off-Line versus On-Line Scheduling.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT V SYSTEM DESIGN TECHNIQUES 9+6

Design Methodologies – Requirement Analysis – Specification – System Analysis and Architecture Design – Quality Assurance – Design Examples – Telephone PBX – Ink jet printer – Personal Digital Assistants – Set-Top Boxes.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

SUGGESTED ACTIVITIES:

1. Study of ARM evaluation system
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt.
7. Principles of Mailbox.
8. Interrupt performance characteristics of ARM and FPGA.
9. Flashing of LEDS.
10. Interfacing stepper motor and temperature sensor.

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Understand different architectures of embedded processor, microcontroller and peripheral devices. Interface memory and peripherals with embedded systems.

CO2: Interface memory and peripherals with embedded systems.

CO3: Work with embedded network environment.

CO4: Understand challenges in Real time operating systems.

CO5: Design and 85nalyse applications on embedded systems.

TOTAL:75

REFERENCES

1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things" Wiley Publication, First edition, 2013
2. Andrew N Sloss, D. Symes, C. Wright, Arm system developers guide, Morgan Kauffman/Elsevier, 2006.
3. ArshdeepBahga, Vijay Madisetti, " Internet of Things: A Hands-on-Approach" VPT First Edition, 2014
4. C. M. Krishna and K. G. Shin, "Real-Time Systems , McGraw-Hill, 1997
5. Frank Vahid and Tony Givargis, "Embedded System Design: A Unified Hardware/Software Introduction, John Wiley & Sons.1999
6. Jane.W.S. Liu, "Real-Time systems, Pearson Education Asia,2000
7. Michael J. Pont, "Embedded C, Pearson Education, 2007.
8. Muhammad Ali Mazidi , SarmadNaimi , SepehrNaimi, "The AVR Microcontroller and Embedded Systems: Using Assembly and C" Pearson Education, First edition, 2014
9. Steve Heath, "Embedded System Design, Elsevier, 2005
10. Wayne Wolf, "Computers as Components:Principles of Embedded Computer System Design, Elsevier, 2006.

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	2	-	3	2	-	-
2	-	-	-	3	3	2
3	-	1	2	1	2	2
4	2	2	-	-	3	-
5	3	3	1	-	1	-
Avg	1.3	2	2	2	2.25	2

FULL STACK WEB APPLICATION DEVELOPMENT

Course Code	24CP930	Course Type		INTEGRATED	
Course Offered to	ME-CSE				
Total Teaching Periods	75	L:T:P	3:0:2	Credits	4
Handled by	CSE	Assessment Methods		IAT	ESE
				50 Marks	50 Marks

Prerequisite: Basic knowledge of programming, databases, HTML, CSS, JavaScript, and web technologies.

COURSE OBJECTIVES: To impart the knowledge of

1. Develop TypeScript Application
2. Develop Single Page Application (SPA)
3. Able to communicate with a server over the HTTP protocol
4. Learning all the tools need to start building applications with Node.js
5. Implement the Full Stack Development using MEAN Stack

UNIT I FUNDAMENTALS & TYPESCRIPT LANGUAGE 10

Server-Side Web Applications. Client-Side Web Applications. Single Page Application. About TypeScript. Creating TypeScript Projects. TypeScript Data Types. Variables. Expression and Operators. Functions. OOP in Typescript. Interfaces. Generics. Modules. Enums. Decorators. Enums. Iterators. Generators.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT II ANGULAR 10

About Angular. Angular CLI. Creating an Angular Project. Components. Components Interaction. Dynamic Components. Angular Elements. Angular Forms. Template Driven Forms. Property, Style, Class and Event Binding. Two way Bindings. Reactive Forms. Form Group. Form Controls. About Angular Router. Router Configuration. Router State. Navigation Pages. Router Link. Query Parameters. URL matching. Matching Strategies. Services. Dependency Injection. HttpClient. Read Data from the Server. CRUD Operations. Http Header Operations. Intercepting requests and responses.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT III NODE.js **10**

About Node.js. Configuring Node.js environment. Node Package Manager NPM. Modules. Asynchronous Programming. Call Stack and Event Loop. Callback functions. Callback errors. Abstracting callbacks. Chaining callbacks. File System. Synchronous vs. asynchronous I/O. Path and directory operations. File Handle. File Synchronous API. File Asynchronous API. File Callback API. Timers. Scheduling Timers. Timers Promises API. Node.js Events. Event Emitter. Event Target and Event API. Buffers. Buffers and TypedArrays. Buffers and iteration. Using buffers for binary data. Flowing vs. non-flowing streams. JSON.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT IV EXPRESS.Js **7**

xpress.js. How Express.js Works. Configuring Express.js App Settings. Defining Routes. Starting the App. Express.js Application Structure. Configuration, Settings. Middleware. body-parser. cookie- parser. express-session. response-time. Template Engine. Jade. EJS. Parameters. Routing. router.route(path). Router Class. Request Object. Response Object. Error Handling. RESTful.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT V MONGODB **8**

Introduction to MongoDB. Documents. Collections. Subcollections. Database. Data Types. Dates. Arrays. Embedded Documents. CRUD Operations. Batch Insert. Insert Validation. Querying The Documents. Cursors. Indexing. Unique Indexes. Sparse Indexes. Special Index and Collection Types. Full-Text Indexes. Geospatial Indexing. Aggregation framework.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

30

LIST OF EXPERIMENTS

1. Accessing the Weather API from Angular
2. Accessing the Stock Market API from Angular
3. Call the Web Services of Express.js From Angular
4. Read the data in Node.js from MongoDB
5. CRUD operation in MongoDB using Angular

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**
Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Develop basic programming skills using Javascript

CO2: Implement a front-end web application using Angular.

CO3: Will be able to create modules to organise the server

CO4: Build RESTful APIs with Node, Express and MongoDB with confidence.

CO5: Will learn to Store complex, relational data in MongoDB using Mongoose

TOTAL : 75

REFERENCES

1. Adam Freeman, Essential TypeScript, Apress, 2019
2. Mark Clow, Angular Projects, Apress, 2018
3. Alex R. Young, Marc Harter,Node.js in Practice, Manning Publication, 2014
4. Pro Express.js, Azat Mardan, Apress, 2015
5. MongoDB in Action, Kyle Banker, Peter Bakkum, Shaun Verch, Douglas Garrett, Tim Hawkins, Manning Publication, Second edition, 2016

CO-PO Mapping

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	-	-	2	3	3	3
2	-	-	2	3	3	3
3	2	-	1	-	3	3
4	2	-	2	-	3	3
5	3	3	-	-	3	3
Avg	2.33	3	1.75	3	3	3

BIO INFORMATICS

Course Code	24CP931	Course Type		INTEGRATED	
Course Offered to	ME-CSE				
Total Teaching Periods	75	L:T:P	3:0:2	Credits	4
Handled by	CSE	Assessment Methods		IAT 50 Marks	ESE 50 Marks

Prerequisite: Basic knowledge of biology, programming, databases, and statistics.

COURSE OBJECTIVES: To impart the knowledge of

1. Exposed to the need for Bioinformatics technologies
2. Be familiar with the modeling techniques
3. Learn microarray analysis
4. Exposed to Pattern Matching and Visualization
5. To know about Microarray Analysis

UNIT I INTRODUCTION **9**

Need for Bioinformatics technologies – Overview of Bioinformatics technologies Structural bioinformatics – Data format and processing – Secondary resources and applications – Role of Structural bioinformatics – Biological Data Integration System.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT II DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS **9**

Bioinformatics data – Data warehousing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture and applications in bioinformatics.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT III MODELING FOR BIOINFORMATICS **9**

Hidden Markov modeling for biological data analysis – Sequence identification – Sequence classification – multiple alignment generation – Comparative modeling –Protein modeling – genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks – Molecular modeling – Computer programs for molecular modeling.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT IV PATTERN MATCHING AND VISUALIZATION 9

Gene regulation – motif recognition – motif detection – strategies for motif detection – Visualization – Fractal analysis – DNA walk models – one dimension – two dimension – higher dimension – Game representation of biological sequences – DNA, Protein, Amino acid sequences.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT V MICROARRAY ANALYSIS 9

Microarray technology for genome expression study – image analysis for data extraction – preprocessing – segmentation – gridding – spot extraction – normalization, filtering – cluster analysis – gene network analysis – Compared Evaluation of Scientific Data Management Systems – Cost Matrix – Evaluation model – Benchmark – Tradeoffs.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

TOTAL: 45

LIST OF EXPERIMENTS:

1. Manipulating DNA strings
2. Use Protein Data Bank to visualize and Analyze the Proteins from protein database
3. Explore the Human Genome with the SciPy Stack
4. Hidden Markov Model for Biological Sequence
5. Molecular Modeling using MMTK package
6. Sequence Alignment using Biopython, Pairwise and multiple sequence alignment using ClustalW and BLAST
7. Simple generation and manipulation of genome graphs
8. DNA data handling using Biopython
9. Chaos Game Representation of a genetic sequence
10. Visualize the microarray data using Heatmap

TOTAL: 30

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Understand the different Data formats

CO2: Develop machine learning algorithms.

CO3: Develop models for biological data.

CO4: Apply pattern matching techniques to bioinformatics data – protein data genomic data.

CO5: Apply micro array technology for genomic expression study.

TOTAL: 75

REFERENCES

1. Yi-Ping Phoebe Chen (Ed), "BioInformatics Technologies", First Indian Reprint, Springer Verlag, 2007.
2. Bryan Bergeron, "Bio Informatics Computing", Second Edition, Pearson Education, 2015.
3. Arthur M Lesk, "Introduction to Bioinformatics", Second Edition, Oxford University Press, 2019

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	1	1	-	-	-	3
2	1	1	2	2	1	2
3	1	2	1	1	3	3
4	1	2	2	2	2	2
5	1	2	1	-	2	3
Avg	1.00	1.60	1.50	1.67	2.00	2.60

CYBER PHYSICAL SYSTEMS

Course Code	24CP932	Course Type		INTEGRATED	
Course Offered to	ME-CSE				
Total Teaching Periods	75	L:T:P	3:0:2	Credits	4
Handled by	CSE	Assessment Methods		IAT	ESE
				50 Marks	50 Marks

Prerequisite: Basic knowledge of embedded systems, sensors, networking, control systems, and programming fundamentals.

COURSE OBJECTIVES: To impart the knowledge of

1. To learn about the principles of cyber-physical systems
2. To familiarize with the basic requirements of CPS.
3. To know about CPS models
4. To facilitate the students to understand the CPS foundations
5. To make the students explore the applications and platforms.
6. To provide introduction to practical aspects of cyber physical systems.
7. To equip students with essential tools to implement CPS.

UNIT I INTRODUCTION TO CYBER-PHYSICAL SYSTEMS 6

Cyber-Physical Systems(CPS)-Emergence of CPS, Key Features of Cyber-Physical Systems,, CPS Drivers-Synchronous Model : Reactive Components, Properties of Components, Composing Components, Designs-Asynchronous Model of CPS: Processes, Design Primitives, Coordination Protocols

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT II CPS - REQUIREMENTS 12

Safety Specifications: Specifications, Verifying Invariants, Enumerative Search, Symbolic Search- Liveness Requirements: Temporal Logic, Model Checking, Proving Liveness

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT III CPS MODELS 9

Dynamical Systems: Continuous, Linear Systems-Time Models, Linear Systems, Designing Controllers, Analysis Techniques- Timed Model: Processes, Protocols, Automata- Hybrid Dynamical Models

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT IV **CPS FOUNDATIONS** **9**

Symbolic Synthesis for CPS- Security in CPS-Synchronization of CPS-Real-Time Scheduling for CPS

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

UNIT V **APPLICATIONS AND PLATFORMS** **9**

Medical CPS- CPS Built on Wireless Sensor Networks- CyberSim User Interface- iClebo Kobuki - iRobot Create- myRIO- Cybersim- Matlab toolboxes - Simulink.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L4

LIST OF EXPERIMENTS **30**

1. Installation of Xilinx SDK, LABVIEW, MatLab and Cybersim
2. Installation of, myRIO iRobot Create Wiring, Kobuki Wiring
3. CPS DEsign with the iRobot Create
4. CPS Design with the Kobuki.
5. Write a program in MATLAB to implement open loop system stability.
6. Write a program in MATLAB to implement timed automation.

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Explain the core principles behind CPS

CO2: Discuss the requirements of CPS.

CO3: Explain the various models of CPS.

CO4: Describe the foundations of CPS.

CO5: Use the various platforms to implement the CPS.

TOTAL: 75

REFERENCES

1. Raj Rajkumar, Dionisio De Niz , and Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional, 2016
2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press, 2015.
3. Lee, Edward Ashford, and Sanjit Arunkumar Seshia. Introduction to embedded systems: A cyber physical systems approach. 2nd Edition, 2017
4. André Platzer, Logical Analysis of Hybrid Systems: Proving Theorems for Complex
5. Dynamics., Springer, 2010. 426 pages,ISBN 978-3-642-14508-7.
6. Jean J. Labrosse, Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C, The publisher, Paul Temme, 2011.
7. Jensen, Jeff, Lee, Edward, A Seshia, Sanjit, An Introductory Lab in Embedded and Cyber- Physical Systems, http://leeseshia.org/lab, 2014.
8. documentation | KOBUKI (yujinrobot.com)

CO-PO Mapping

CO	POs					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	3	3	3	-	1	-
2	2	2	2	-	1	--
3	-	-	3	1	-	1
4	-	-	3	1	-	1
5	2	-	2	3	3	3
Avg	2.3	2.5	2.6	1.7	1.7	1.7

MIXED REALITY

Course Code	24CP933	Course Type		INTEGRATED	
Course Offered to	ME-CSE				
Total Teaching Periods	75	L:T:P	3:0:2	Credits	4
Handled by	CSE	Assessment Methods		IAT	ESE
				50 Marks	50 Marks

Prerequisite: Basic knowledge of computer graphics, programming, 3D modeling, and human-computer interaction concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. To study about Fundamental Concept and Components of Virtual Reality
2. To study about Interactive Techniques in Virtual Reality
3. To study about Visual Computation in Virtual Reality
4. To study about Augmented and Mixed Reality and Its Applications
5. To know about I/O Interfaces and its functions.

UNIT I INTRODUCTION TO VIRTUAL REALITY 9

Introduction, Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality. Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark 3D Computer Graphics: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, Simple 3D modelling, Illumination models, Reflection models, Shading algorithms, Radiosity, Hidden Surface Removal, Realism Stereographic image.

Suggested Activities:

- Flipped classroom on uses of MR applications.
- Videos – Experience the virtual reality effect.
- Assignment on comparison of VR with traditional multimedia applications.

Suggested Evaluation Methods:

- Tutorial – Applications of MR.
- Quizzes on the displayed video and the special effects

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II INTERACTIVE TECHNIQUES IN VIRTUAL REALITY 9

Introduction, from 2D to 3D, 3D spaces curves, 3D boundary representation Geometrical Transformations: Introduction, Frames of reference, Modeling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems.

Suggested Activities:

- Flipped classroom on modeling three dimensional objects.
- External learning – Collision detection algorithms.
- Practical – Creating three dimensional models.

Suggested Evaluation Methods:

- Tutorial – Three dimensional modeling techniques.
- Brainstorming session on collision detection algorithms.
- Demonstration of three dimensional scene creation.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III VISUAL COMPUTATION IN VIRTUAL REALITY 9

Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object inbetweening, free from deformation, particle system. Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.

Suggested Activities:

- External learning – Different types of programming toolkits and Learn different types of available VR applications.
- Practical – Create VR scenes using any toolkit and develop applications.

Suggested Evaluation Methods:

- Tutorial – VR tool comparison.
- Brainstorming session on tools and technologies used in VR.
- Demonstration of the created VR applications.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT IV AUGMENTED AND MIXED REALITY 9

Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems

Suggested Activities:

- External learning - AR Systems

Suggested Evaluation Methods:

- Brainstorming session different AR systems and environments.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT V I/O INTERFACE IN VR & APPLICATION OF VR 9

Human factors: Introduction, the eye, the ear, the somatic senses. VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. VR Software: Introduction, Modeling virtual world, Physical simulation, VR toolkits, Introduction to VRML, Input -- Tracker, Sensor, Digital globe, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / Haptic Devices. VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR

Suggested Activities:

- External learning – Different types of sensing and tracking devices for creating mixed reality environments.
- Practical – Create MR scenes using any toolkit and develop applications.

Suggested Evaluation Methods:

- Tutorial – Mobile Interface Design.
- Brainstorming session on wearable computing devices and games design.
- Demonstration and evaluation of the developed MR application.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

TOTAL: 45

PRACTICALS:

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection methods by handling the camera.
3. Download objects from asset stores and apply various lighting and shading effects.
4. Model three dimensional objects using various modeling techniques and apply textures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
8. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
9. Develop MR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization and surgery simulation.
10. Develop simple MR enabled gaming applications.

TOTAL: 30

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Understand the Fundamental Concept and Components of Virtual Reality

CO2: Able to know the Interactive Techniques in Virtual Reality

CO3: Can know about Visual Computation in Virtual Reality

CO4: Able to know the concepts of Augmented and Mixed Reality and Its Applications

CO5: Know about I/O Interfaces and its functions.

TOTAL: 75

REFERENCES

1. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.
2. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann,First Edition 2013.
3. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
4. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.
5. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.
6. Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley Inter Science, 2nd Edition, 2006.
7. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application and Design", Morgan Kaufmann, 2008

CO-PO Mapping

CO	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1	3	1	3	1	-	-
2	3	-	3	-	1	-
3	3	1	-	-	1	-
4	-	-	-	-	1	-
5	-	1	3	-	-	2
Avg	3	1	3	1	1	2

-

AUDIT COURSES

ENGLISH FOR RESEARCH PAPER WRITING

Course Code	24AX901	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	30	L:T:P	2:0:0	Credits	0
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of English grammar, technical communication, research methodology, and academic writing skills**.**

COURSE OBJECTIVES: To impart the knowledge of

1. Teach how to improve writing skills and level of readability
2. Tell about what to write in each section
3. Summarize the skills needed when writing a Title
4. Infer the skills needed when writing the Conclusion
5. Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6

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

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II PRESENTATION SKILLS 6

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

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III TITLE WRITING SKILLS 6

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV RESULT WRITING SKILLS 6

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

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V VERIFICATION SKILLS **6**

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

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL: 30

COURSE OUTCOMES:

CO1 –Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES:

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

DISASTER MANAGEMENT

Course Code	24AX902	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	30	L:T:P	2:0:0	Credits	0
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of environmental science, geography, safety practices, and emergency response concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. Summarize basics of disaster
2. Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
3. Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
4. Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
5. Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION 6

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

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS 6

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

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III DISASTER PRONE AREAS IN INDIA 6

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT 6

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V RISK ASSESSMENT 6

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

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL : 30

COURSE OUTCOMES:

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

CO1: Ability to summarize basics of disaster

CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.

CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

CO5: Ability to develop the strengths and weaknesses of disaster management approaches

REFERENCES:

1. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi,2009.
2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company,2007.
3. Sahni, Pradeep Et.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi,2001.

CONSTITUTION OF INDIA

Course Code	24AX903	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	30	L:T:P	2:0:0	Credits	0
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of Indian history, civics, and governance systems.

COURSE OBJECTIVES: Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
3. Role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
4. To address the role of socialism in India after the commencement of the Bolshevik Revolution 1917 And its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION

History, Drafting Committee, (Composition & Working)

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION

Preamble, Salient Features

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

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

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT IV ORGANS OF GOVERNANCE

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

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT V LOCAL ADMINISTRATION

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

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT VI ELECTION COMMISSION

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

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL: 30

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

Students will be able to:

CO1: Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

CO2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

CO3: Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

CO4:Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING

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

Course Code	24AX904	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	30	L:T:P	2:0:0	Credits	0
Handled by	CSE	Assessment Methods		IAT 40 Marks	ESE 60 Marks

24AX904 **நற்றமிழ் இலக்கியம்** **L T P C**
2 0 0 0

UNIT I **சங்க இலக்கியம்** **6**

1. தமிழின் துவக்க நூல் தொல்காப்பியம்
   – எழுத்து, சொல், பொருள்
2. அகநானூறு (82)
   - இயற்கை இன்னிசை அரங்கம்
3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி
4. புறநானூறு (95,195)
   - போரை நிறுத்திய ஔவையார்

UNIT II **அறநெறித் தமிழ்** **6**

1. அறநெறி வகுத்த திருவள்ளுவர்
   - அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புறவு அறிதல், ஈகை, புகழ்
2. பிற அறநூல்கள் - இலக்கிய மருந்து
   – ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)

UNIT III **இரட்டைக் காப்பியங்கள்** **6**

1. கண்ணகியின் புரட்சி
   - சிலப்பதிகார வழக்குரை காதை
2. சமூகசேவை இலக்கியம் மணிமேகலை
   - சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை

UNIT IV **அருள்நெறித் தமிழ்** **6**

1. சிறுபாணாற்றுப்படை
   - பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஔவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள்
2. நற்றிணை
   - அன்னைக்குரிய புன்னை சிறப்பு
3. திருமந்திரம் (617, 618)
   - இயமம் நியமம் விதிகள்
4. தர்மச்சாலையை நிறுவிய வள்ளலார்

5. புறநானூறு
   - சிறுவனே வள்ளலானான்
6. அகநானூறு (4) - வண்டு
   நற்றிணை (11) - நண்டு
   கலித்தொகை (11) - யானை, புறா
   ஐந்திணை 50 (27) - மான்
   ஆகியவை பற்றிய செய்திகள்

UNIT V **நவீன தமிழ் இலக்கியம்** **6**

1. உரைநடைத் தமிழ்,
- தமிழின் முதல் புதினம்,
- தமிழின் முதல் சிறுகதை,
- கட்டுரை இலக்கியம்,
- பயண இலக்கியம்,
- நாடகம்,
2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும்,
3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும்,
4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,
5. அறிவியல் தமிழ்,
6. இணையத்தில் தமிழ்,
7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.

TOTAL: 30 PERIODS

தமிழ் இலக்கிய வெளியீடுகள் / புத்தகங்கள்

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University)
   - www.tamilvu.org
2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)
   -https://ta.wikipedia.org
3. தர்மபுர ஆதீன வெளியீடு
4. வாழ்வியல் களஞ்சியம்
   - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்
5. தமிழ்கலைக் களஞ்சியம்
   - தமிழ் வளர்ச்சித் துறை (thamilvalarchithurai.com)
6. அறிவியல் களஞ்சியம்
   - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்

INTEGRATED WATER RESOURCES MANAGEMENT

Course Code	24OE901	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of environmental science, hydrology, water resources, and sustainable development concepts**.**

COURSE OBJECTIVE: To impart the knowledge of

1. Students will be introduced to the concepts and principles of IWRM, which is inclusive of the economics, public-private partnership, water & health, water & food security and legal & regulatory settings.

UNIT I CONTEXT FOR IWRM **9**

Water as a global issue: key challenges – Definition of IWRM within the broader context of development – Key elements of IWRM - Principles – Paradigm shift in water management - Complexity of the IWRM process – UN World Water Assessment - SDGs.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II WATER ECONOMICS **9**

Economic view of water issues: economic characteristics of water good and services – Non- market monetary valuation methods – Water economic instruments – Private sector involvement in water resources management: PPP objectives, PPP models, PPP processes, PPP experiences through case studies.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III LEGAL AND REGULATORY SETTINGS **9**

Basic notion of law and governance: principles of international and national law in the area of water management - Understanding UN law on non-navigable uses of international water courses –International law for groundwater management – World Water Forums – Global Water Partnerships - Development of IWRM in line with legal and regulatory framework.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV WATER AND HEALTH WITHIN THE IWRM CONTEXT **9**

Links between water and health: options to include water management interventions for health – Health protection and promotion in the context of IWRM – Global burden of Diseases Health impact assessment of water resources development projects – Case studies.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT V AGRICULTURE IN THE CONCEPT OF IWRM **9**

Water for food production: 'blue' versus 'green' water debate – Water foot print - Virtual water trade for achieving global water and food security –- Irrigation efficiencies, irrigation methods current water pricing policy– scope to relook pricing.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

TOTAL: 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES

On completion of the course, the student is expected to be able to

CO1 Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.

CO2 Select the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.

CO3 Apply law and governance in the context of IWRM.

CO4 Discuss the linkages between water-health; develop a HIA framework.

CO5 Analyse how the virtual water concept pave way to alternate policy options.

REFERENCES:

1. Cech Thomas V., Principles of water resources: history, development, management and policy. John Wiley and Sons Inc., New York. 2003.
2. Mollinga .P. etal " Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006.
3. Technical Advisory Committee, Integrated Water Resources management, Technical Advisory Committee Background Paper No: 4. Global water partnership, Stockholm, Sweden. 2002.
4. Technical Advisory Committee, Dublin principles for water as reflected in comparative assessment of institutional and legal arrangements for Integrated Water Resources Management, Technical Advisory Committee Background paper No: 3. Global water partnership, Stockholm, Sweden. 1999.
5. Technical Advisory Committee, Effective Water Governance". Technical Advisory Committee Background paper No: 7. Global water partnership, Stockholm, Sweden, 2003.

WATER, SANITATION AND HEALTH

Course Code	24OE902	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT 50 Marks	ESE 50 Marks

Prerequisite: Basic knowledge of environmental science, public health, sanitation practices, and water resource management.

COURSE OBJECTIVES: To impart the knowledge of

1.Understand the accelerating health impacts due to the present managerial aspects and initiatives in water and sanitation and health sectors in the developing scenario

UNIT I FUNDAMENTALS WASH 9

Meanings and Definition: Safe Water- Health, Nexus: Water- Sanitation - Health and Hygiene– Equity issues-Water security - Food Security. Sanitation And Hygiene (WASH) and Integrated Water Resources Management (IWRM) - Need and Importance of WASH

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II MANAGERIAL IMPLICATIONS AND IMPACT 9

Third World Scenario – Poor and Multidimensional Deprivation--Health Burden in Developing Scenario -Factors contribute to water, sanitation and hygiene related diseases-Social: Social Stratification and Literacy Demography: Population and Migration- Fertility - Mortality- Environment: Water Borne- Water Washed and Water Based Diseases - Economic: Wage - Water and Health Budgeting - Psychological: Non-compliance - Disease Relapse - Political: Political Will.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III CHALLENGES IN MANAGEMENT AND DEVELOPMENT 9

Common Challenges in WASH - Bureaucracy and Users- Water Utilities -Sectoral Allocation:- Infrastructure- Service Delivery: Health services: Macro and Micro- level: Community and Gender Issues- Equity Issues - Paradigm Shift: Democratization of Reforms and Initiatives.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3UNIT IV GOVERNANCE 9

Public health -Community Health Assessment and Improvement Planning (CHA/CHIP)- Infrastructure and Investments on Water, (WASH) - Cost Benefit Analysis – Institutional Intervention-Public Private Partnership - Policy Directives - Social Insurance -Political Will vs Participatory Governance –

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V INITIATIVES **9**

Management vs Development -Accelerating Development- Development Indicators -Inclusive Development-Global and Local- Millennium Development Goal (MDG) and Targets - Five Year Plans - Implementation - Capacity Building - Case studies on WASH.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL: 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions.

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

OUTCOMES:

CO1 Capture to fundamental concepts and terms which are to be applied and understood all through the study.

CO2 Comprehend the various factors affecting water sanitation and health through the lens of third world scenario.

CO3 Critically analyse and articulate the underlying common challenges in water, sanitation and health.

CO4 Acquire knowledge on the attributes of governance and its say on water sanitation and health.

CO5 Gain an overarching insight in to the aspects of sustainable resource management in the absence of a clear level playing field in the developmental aspects.

REFERENCES

1. Bonitha R., Beaglehole R.,Kjellstorm, 2006, "Basic Epidemiology", 2nd Edition, World Health Organization.
2. Van Note Chism, N. and Bickford, D. J. (2002), Improving the environment for learning: An expanded agenda. New Directions for Teaching and Learning, 2002: 91–98. doi: 10.1002/tl.83Improving the Environment for learning: An Expanded Agenda
3. National Research Council. *Global Issues in Water, Sanitation, and Health: Workshop Summary***.** Washington, DC: The National Academies Press, 2009.
4. Sen, Amartya 1997. On Economic Inequality. Enlarged edition, with annex by JamesFoster and Amartya Sen, Oxford: Claredon Press, 1997.
5. Intersectoral Water Allocation Planning and Management, 2000, World Bank Publishers www. Amazon.com
6. Third World Network.org (www.twn.org).

PRINCIPLES OF SUSTAINABLE DEVELOPMENT

Course Code	24OE903	Course Type		INTEGRATED	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				50 Marks	50 Marks

Prerequisite: Basic knowledge of environmental science, ecology, natural resources, and sustainable development concepts.

COURSE OBJECTIVES: To impart the knowledge of

1.To impart knowledge on environmental, social and economic dimensions of sustainability and the principles evolved through landmark events so as to develop an action mindset for sustainable development.

UNIT I SUSTAINABILITY AND DEVELOPMENT CHALLEGES 9

Definition of sustainability – environmental, economical and social dimensions of sustainability sustainable development models – strong and weak sustainability – defining development- millennium development goals – mindsets for sustainability: earthly, analytical, precautionary, action and collaborative– syndromes of global change: utilisation syndromes, development syndromes, and sink syndromes – core problems and cross cutting Issues of the 21 century global, regional and local environmental issues – social insecurity - resource degradation –climate change – desertification.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II PRINCIPLES AND FRAME WORK 9

History and emergence of the concept of sustainable development - our common future - Stockholm to Rio plus 20– Rio Principles of sustainable development – Agenda 21 natural step- peoples earth charter – business charter for sustainable development –UN Globa Compact - Role of civil society, business and government – United Nations' 2030 Agenda for sustainable development – 17 sustainable development goals and targets, indicators and intervention areas

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III SUSTAINABLE DEVELOPMENT AND WELLBEING 9

The Unjust World and inequities - Quality of Life - Poverty, Population and Pollution - Combating Poverty - - Demographic dynamics of sustainability - Strategies to end Rural and Urban Poverty and Hunger – Sustainable Livelihood Framework- Health, Education and Empowerment of Women, Children, Youth, Indigenous People, Non-Governmental Organizations, Local Authorities and Industry for Prevention, Precaution , Preservation and Public participation.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV SUSTAINABLE SOCIO-ECONOMIC SYSTEMS 10

Sustainable Development Goals and Linkage to Sustainable Consumption and Production – Investing in Natural Capital- Agriculture, Forests, Fisheries - Food security and nutrition and sustainable agriculture- Water and sanitation - Biodiversity conservation and Ecosystem integrity – Ecotourism - Sustainable Cities – Sustainable Habitats- Green Buildings - Sustainable Transportation — Sustainable Mining - Sustainable Energy– Climate Change – Mitigation and Adaptation - Safeguarding Marine Resources - Financial Resources and Mechanisms

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V ASSESSING PROGRESS AND WAY FORWARD 8

Nature of sustainable development strategies and current practice- Sustainability in global, regional and national context –Approaches to measuring and analysing sustainability– limitations of GDP- Ecological Footprint- Human Development Index- Human Development Report – National initiatives for Sustainable Development - Hurdles to Sustainability - Science and Technology for sustainable development –Performance indicators of sustainability and Assessment mechanism – Inclusive Green Growth and Green Economy – National Sustainable Development Strategy Planning and National Status of Sustainable Development Goals

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL: 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1	Explain and evaluate current challenges to sustainability, including modern world social, environmental, and economic structures and crises.
CO2	Identify and critically analyze the social environmental, and economic dimensions of sustainability in terms of UN Sustainable development goals
CO3	Develop a fair understanding of the social, economic and ecological linkage of Human well being, production and consumption
CO4	Evaluate sustainability issues and solutions using a holistic approach that focuses on connections between complex human and natural systems.
CO5	Integrate knowledge from multiple sources and perspectives to understand environmental limits governing human societies and economies and social justice dimensions of sustainability.

REFERENCES:

1. Tom Theis and Jonathan Tomkin, Sustainability: A Comprehensive Foundation, Rice University, Houston, Texas, 2012
2. A guide to SDG interactions:from science to implementation, International Council for Science, Paris,2017
3. Karel Mulder, Sustainable Development for Engineers - A Handbook and Resource Guide, Rouledge Taylor and Francis, 2017.
4. The New Global Frontier - Urbanization, Poverty and Environmentin the 21st Century - *George Martine,Gordon McGranahan,Mark Montgomery and Rogelio Fernández-Castilla,* IIED and UNFPA, Earthscan, UK, 2008
5. Nolberto Munier, Introduction to Sustainability: Road to a Better Future, Springer, 2006
6. Barry Dalal Clayton and Stephen Bass, Sustainable Development Strategies- a resource book", Earthscan Publications Ltd, London, 2002.

ENVIRONMENTAL IMPACT ASSESSMENT

Course Code	24OE904	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	75	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				50 Marks	50 Marks

Prerequisite: Basic knowledge of environmental science, ecology, pollution control, and sustainable development concepts.

COURSE OBJECTIVES: To impart the knowledge of

1.To make the students to understand environmental clearance, its legal requirements and to provide knowledge on overall methodology of EIA, prediction tools and models, environmental management plan and case studies.

UNIT I INTRODUCTION **9**

Historical development of Environmental Impact Assessment (EIA). Environmental Clearance- EIA in project cycle. legal and regulatory aspects in India – types and limitations of EIA –EIA process-screening – scoping - terms of reference in EIA- setting – analysis – mitigation. Cross sectoral issues –public hearing in EIA- EIA consultant accreditation.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II IMPACT INDENTIFICATION AND PREDICTION **10**

Matrices – networks – checklists – cost benefit analysis – analysis of alternatives – expert systems in EIA. prediction tools for EIA – mathematical modeling for impact prediction – assessment of impacts – air – water – soil – noise – biological — cumulative impact assessment

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III SOCIO-ECONOMIC IMPACT ASSESSMENT **8**

Socio-economic impact assessment - relationship between social impacts and change in community and institutional arrangements. factors and methodologies- individual and family level impacts. communities in transition-rehabilitation

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV EIA DOCUMENTATION AND ENVIRONMENTAL MANAGEMENT PLAN 9

Environmental management plan - preparation, implementation and review – mitigation and rehabilitation plans – policy and guidelines for planning and monitoring programmes – post project audit – documentation of EIA findings – ethical and quality aspects of environmental impact assessment

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V CASE STUDIES 9

Mining, power plants, cement plants, highways, petroleum refining industry, storage & handling of hazardous chemicals, common hazardous waste facilities, CETPs, CMSWMF, building and construction projects

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL: 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Understand need for environmental clearance, its legal procedure, need of EIA, its types, stakeholders and their roles

CO2 Understand various impact identification methodologies, prediction techniques and model of impacts on various environments

CO3 Understand relationship between social impacts and change in community due to development activities and rehabilitation methods

CO4 Document the EIA findings and prepare environmental management and monitoring plan

CO5 Identify, predict and assess impacts of similar projects based on case studies

REFERENCES:

1. EIA Notification 2006 including recent amendments, by Ministry of Environment, Forest and Climate Change, Government of India
2. Sectoral Guidelines under EIA Notification by Ministry of Environment, Forest and Climate Change, Government of India
3. Canter, L.W., Environmental Impact Assessment, McGraw Hill, New York. 1996
4. Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey. 2003
5. Lee N. and George C. 2000. Environmental Assessment in Developing and Transitional Countries. Chichester: Willey
6. World Bank –Source book on EIA ,1999
7. Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification Assessment and Control, 4th Edition, Butterworth Heineman, 2012.

VIBRATION AND NOISE CONTROL STRATEGIES

Course Code	24OE905	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of engineering mechanics, vibrations, acoustics, and control systems

COURSE OBJECTIVES: To impart the knowledge of

1. To appreciate the basic concepts of vibration in damped and undamped systems
2. To appreciate the basic concepts of noise, its effect on hearing and related terminology
3. To use the instruments for measuring and analyzing the vibration levels in a body
4. To use the instruments for measuring and analyzing the noise levels in a system
5. To learn the standards of vibration and noise levels and their control techniques

UNIT- I BASICS OF VIBRATION 9

Introduction – Sources and causes of Vibration-Mathematical Models - Displacement, velocity and Acceleration - Classification of vibration: free and forced vibration, undamped and damped vibration, linear and non-linear vibration - Single Degree Freedom Systems - Vibration isolation - Determination of natural frequencies

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT- II BASICS OF NOISE 9

Introduction - Anatomy of human ear - Mechanism of hearing - Amplitude, frequency, wavelength and sound pressure level - Relationship between sound power, sound intensity and sound pressure level - Addition, subtraction and averaging decibel levels - sound spectra Types of sound fields - Octave band analysis - Loudness.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT- III INSTRUMENTATION FOR VIBRATION MEASUREMENT 9

Experimental Methods in Vibration Analysis.- Vibration Measuring Instruments - Selection of Sensors - Accelerometer Mountings - Vibration Exciters - Mechanical, Hydraulic, Electromagnetic and Electrodynamics – Frequency Measuring Instruments -. System Identification from Frequency Response -Testing for resonance and mode shapes

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT- IV INSTRUMENTATION FOR NOISE MEASUREMENT AND ANALYSIS 9

Microphones - Weighting networks - Sound Level meters, its classes and calibration - Noise measurements using sound level meters - Data Loggers - Sound exposure meters - Recording of noise - Spectrum analyser - Intensity meters - Energy density sensors - Sound source localization.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT- V METHODS OF VIBRATION CONTROL, SOURCES OF NOISE AND ITS CONTROL 9

Specification of Vibration Limits – Vibration severity standards - Vibration as condition Monitoring Tool – Case Studies - Vibration Isolation methods - Dynamic Vibration Absorber – Need for Balancing - Static and Dynamic Balancing machines – Field balancing - Major sources of noise - Noise survey techniques – Measurement technique for vehicular noise - Road vehicles Noise standard – Noise due to construction equipment and domestic appliances – Industrial noise sources and its strategies – Noise control at the source – Noise control along the path – Acoustic Barriers – Noise control at the receiver -- Sound transmission through barriers – Noise reduction Vs Transmission loss – Enclosures

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

TOTAL: 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

On Completion of the course the student will be able to

1. Apply the basic concepts of vibration in damped and undamped systems
2. Apply the basic concepts of noise and to understand its effects on systems
3. Select the instruments required for vibration measurement and its analysis
4. Select the instruments required for noise measurement and its analysis.
5. Recognize the noise sources and to control the vibration levels in a body and to control noise under different strategies.

REFERENCES:

1. Singiresu S. Rao, “Mechanical Vibrations”, Pearson Education Incorporated, 2017.
2. Graham Kelly. Sand Shashidhar K. Kudari, “Mechanical Vibrations”, Tata McGraw –Hill Publishing Com. Ltd., 2007.
3. Ramamurti. V, “Mechanical Vibration Practice with Basic Theory”, Narosa Publishing House, 2000.
4. William T. Thomson, “Theory of Vibration with Applications”, Taylor & Francis, 2003.
5. G.K. Grover, “Mechanical Vibrations”, Nem Chand and Bros.,Roorkee, 2014.
6. A.G. Ambekar, “Mechanical Vibrations and Noise Engineering”, PHI Learning Pvt. Ltd., 2014.
7. David A. Bies and Colin H. Hansen, “Engineering Noise Control – Theory and Practice”, Spon Press, London and New York, 2009.

ENERGY CONSERVATION AND MANAGEMENT IN DOMESTIC SECTORS

Course Code	24OE906	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	75	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of energy resources, electrical systems, environmental science, and sustainable energy concepts**.**

COURSE OBJECTIVES: To impart the knowledge of

1. To learn the present energy scenario and the need for energy conservation
2. To understand the different measures for energy conservation in utilities.
3. Acquaint students with principle theories, materials, and construction techniques to create energy efficient buildings.
4. To identify the energy demand and bridge the gap with suitable technology for sustainable habitat
5. To get familiar with the energy technology, current status of research and find the ways to optimize a system as per the user requirement

UNIT I ENERGY SCENARIO 9

Primary energy resources - Sectorial energy consumption (domestic, industrial and other sectors), Energy pricing, Energy conservation and its importance, Energy Conservation Act- 2001 and its features – Energy star rating.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II HEATING, VENTILLATION & AIR CONDITIONING 9

Basics of Refrigeration and Air Conditioning – COP / EER / SEC Evaluation – SPV system design & optimization for Solar Refrigeration.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III LIGHTING, COMPUTER, TV 9

Specification of Luminaries – Types – Efficacy – Selection & Application – Time Sensors – Occupancy Sensors – Energy conservation measures in computer – Television – Electronic devices.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT IV ENERGY EFFICIENT BUILDINGS 9

Conventional versus Energy efficient buildings – Landscape design – Envelope heat loss and heat gain – Passive cooling and heating – Renewable sources integration.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V ENERGY STORAGE TECHNOLOGIES 9

Necessity & types of energy storage – Thermal energy storage – Battery energy storage, charging and discharging– Hydrogen energy storage & Super capacitors – energy density and safety issues – Applications.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL: 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**
Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

1. Understand technical aspects of energy conservation scenario.
2. Energy audit in any type for domestic buildings and suggest the conservation measures.
3. Perform building load estimates and design the energy efficient landscape system.
4. Gain knowledge to utilize an appliance/device sustainably.
5. Understand the status and current technological advancement in energy storage field.

REFERENCES:

1. Yogi Goswami, Frank Kreith, Energy Efficiency and Renewable energy Handbook, CRC Press, 2016
2. ASHRAE Handbook 2020 – HVAC Systems & Equipment
3. Paolo Bertoldi, Andrea Ricci, Anibal de Almeida, Energy Efficiency in Household Appliances and Lighting, Conference proceedings, Springer, 2001
4. David A. Bainbridge, Ken Haggard, Kenneth L. Haggard, Passive Solar Architecture: Heating, Cooling, Ventilation, Daylighting, and More Using Natural Flows, Chelsea Green Publishing, 2011.
5. Guide book for National Certification Examination for Energy Managers and Energy Auditors (Could be downloaded from www.energymanagertraining.com)
6. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, John Wiley & Sons 2002.
7. Robert Huggins, Energy Storage: Fundamentals, Materials and Applications, 2nd edition, Springer, 2015
8. Ru-shiliu, Leizhang, Xueliang sun, Electrochemical technologies for energy storage and conversion, Wiley publications, 2012.

ADDITIVE MANUFACTURING

Course Code	24OE907	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of manufacturing processes, engineering materials, CAD modeling, and computer-aided design concepts.

Course Objectives: To impart the knowledge of

1. To understand the fundamentals and process chain of Additive Manufacturing (AM).
2. To learn design methodologies and CAD preparation techniques for additive manufacturing.
3. To study various additive manufacturing processes such as vat polymerization, extrusion, sheet lamination, and powder-based techniques.
4. To analyze the materials, applications, advantages, and limitations of different AM technologies.
5. To explore industrial applications, business opportunities, and future trends in additive manufacturing.

UNIT I INTRODUCTION **9**

Need - Development - Rapid Prototyping Rapid Tooling – Rapid Manufacturing – Additive Manufacturing. AM Process Chain- Classification – Benefits.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II DESIGN FOR ADDITIVE MANUFACTURING **9**

CAD Model Preparation - Part Orientation and Support Structure Generation -Model Slicing - Tool Path Generation Customized Design and Fabrication - Case Studies.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III VAT POLYMERIZATION **9**

Stereolithography Apparatus (SLA)- Materials -Process -Advantages Limitations- Applications. Digital Light Processing (DLP) - Materials – Process - Advantages - Applications. Multi Jet Modelling (MJM) - Principles - Process - Materials - Advantages and Limitations.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT IV MATERIAL EXTRUSION AND SHEET LAMINATION 9

Fused Deposition Modeling (FDM)- Process-Materials - Applications and Limitations. Sheet Lamination Process: Laminated Object Manufacturing (LOM)- Basic Principle- Mechanism: Gluing or Adhesive Bonding – Thermal Bonding- Materials- Application and Limitation - Bio- Additive Manufacturing Computer Aided Tissue Engineering (CATE) – Case studies

POWDER BASED PROCESS

Selective Laser Sintering (SLS): Process –Mechanism– Typical Materials and Application- Multi Jet Fusion - Basic Principle-– Materials- Application and Limitation - Three Dimensional Printing - Materials -Process - Benefits and Limitations. Selective Laser Melting (SLM) and Electron Beam Melting (EBM): Materials – Process - Advantages and Applications. Beam Deposition Process: Laser Engineered Net Shaping (LENS)- Process -Material Delivery - Process Parameters - Materials - Benefits -Applications.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT V CASE STUDIES AND OPPORTUNITIES ADDITIVE MANUFACTURING PROCESSES 9

Education and training - Automobile- pattern and mould - tooling - Building Printing-Bio Printing - medical implants -development of surgical tools Food Printing -Printing Electronics. Business Opportunities and Future Directions - Intellectual Property.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

TOTAL: 45

REFERENCES:

1. Andreas Gebhardt and Jan-Steffen Hötter “Additive Manufacturing: 3D Printing for Prototyping and Manufacturing”, Hanser publications, United States, 2015, ISBN: 978-1-56990-582-1.
2. Ian Gibson, David W. Rosen and Brent Stucker “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, 2nd edition, Springer., United States, 2015, ISBN13: 978-1493921126.
3. Amit Bandyopadhyay and Susmita Bose, “Additive Manufacturing”, 1st Edition, CRC Press., United States, 2015, ISBN-13: 978-1482223590
4. Andreas Gebhardt, “Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing”, Hanser Gardner Publication, Cincinnati., Ohio, 2011, ISBN :9783446425521.
5. Chua C.K., Leong K.F., and Lim C.S., “Rapid prototyping: Principles and applications”, Third edition, World Scientific Publishers, 2010.

ELECTRIC VEHICLE TECHNOLOGY

Course Code	24OE908	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of electrical circuits, electronics, electrical machines, energy systems, and automotive engineering concepts.

Course Objectives: To impart the knowledge of

1. To understand the fundamentals, architecture, and components of electric vehicles (EVs).
2. To study electric propulsion systems, energy storage technologies, and battery management systems used in EVs.
3. To learn charging methods, power electronics, and control strategies for electric vehicles.
4. To analyze the performance, efficiency, environmental impact, and challenges of EV technology.
5. To explore recent advancements, applications, and future trends in electric and hybrid electric vehicles.

UNIT I NEED FOR ELECTRIC VEHICLES **9**

History and need for electric and hybrid vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies, comparison of diesel, petrol, electric and hybrid vehicles, limitations, technical challenges

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II ELECTRIC VEHICLE ARCHITECHTURE **9**

Electric vehicle types, layout and power delivery, performance – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, Concepts of hybrid electric drive train, architecture of series and parallel hybrid electric drive train, merits and demerits, mild and full hybrids, plug-in hybrid electric vehicles and range extended hybrid electric vehicles, Fuel cell vehicles.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III ENERGY STORAGE **9**

Batteries – types – lead acid batteries, nickel based batteries, and lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency, Battery modeling and equivalent circuit, battery charging and types, battery cooling, Ultra-capacitors, Flywheel technology, Hydrogen fuel cell, Thermal Management of the PEM fuel cell

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT IV ELECTRIC DRIVES AND CONTROL **9**

Types of electric motors – working principle of AC and DC motors, advantages and limitations, DC motor drives and control, Induction motor drives and control, PMSM and brushless DC motor - drives and control , AC and Switch reluctance motor drives and control – Drive system efficiency – Inverters – DC and AC motor speed controllers

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT V DESIGN OF ELECTRIC VEHICLES **9**

Materials and types of production, Chassis skate board design, motor sizing, power pack sizing, component matching, Ideal gear box – Gear ratio, torque–speed characteristics, Dynamic equation of vehicle motion, Maximum tractive effort – Power train tractive effort Acceleration performance, rated vehicle velocity – maximum gradability, Brake performance,Electronic control system, safety and challenges in electric vehicles. Case study of Nissan leaf, Toyota Prius, tesla model 3, and Renault Zoe cars.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

TOTAL: 45

REFERENCES:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, 2nd edition CRC Press, 2011.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained - Wiley, 2003.
4. Ehsani, M, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals,Theory and Design", CRC Press, 2005

NEW PRODUCT DEVELOPMENT

Course Code	24OE909	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of engineering design, manufacturing processes, product lifecycle, and management principles.

COURSE OBJECTIVES: To impart the knowledge of

1. Applying the principles of generic development process; and understanding the organization structure for new product design and development.
2. Identfying opportunity and planning for new product design and development.
3. Conducting customer need analysis; and setting product specification for new product design and development.
4. Generating, selecting, and testing the concepts for new product design and development.
5. Appling the principles of Industrial design and prototype for new product design and development.

UNIT I INTRODUCTION TO PRODUCTDESIGN & DEVELOPMENT 9

Introduction – Characteristics of Successful Product Development – People involved in Product Design and Development – Duration and Cost of Product Development – The Challenges of Product Development – The Product Development Process – Concept Development: The Front-End Process – Adapting the Generic Product Development Process – Product Development Process Flows – Product Development Organizations.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II OPPORTUNITY DENTIFICATION & PRODUCT PLANNING 9

Opportunity Identification: Definition – Types of Opportunities – Tournament Structure of Opportunity Identification – Effective Opportunity Tournaments – Opportunity Identification Process – Product Planning: Four types of Product Development Projects – The Process of Product Planning.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III IDENTIFYING CUSTOMER NEEDS & PRODUCT SPECIFICATIONS 9

Identifying Customer Needs: The Importance of Latent Needs – The Process of Identifying Customer Needs. Product Specifications: Definition – Time of Specifications Establishment – Establishing Target Specifications – Setting the Final Specifications

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT IV CONCEPT GENERATION, SELECTION & TESTING 9

Concept Generation: Activity of Concept Generation – Structured Approach – Five step method of Concept Generation. Concept Selection: Methodology – Concept Screening and Concepts Scoring. Concept testing: Seven Step activities of concept testing

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNITV INDUSTRIAL DESIGN & PROTOTYPING 9

Industrial Design: Need and Impact–Industrial Design Process. Prototyping – Principles of Prototyping – Prototyping Technologies – Planning for Prototypes.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

TOTAL: 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: Apply the principles of generic development process; and understand the organization structure for new product design and development.

CO2: Identify opportunity and plan for new product design and development.

CO3:Conduct customer need analysis; and set product specification for new product design an development.

CO4:Generate, select, and test the concepts for new product design and development.

CO5:Apply the principles of Industrial design and prototype for design and develop new products.

TEXT BOOK:

1. Ulrich K.T., Eppinger S. D. and Anita Goyal, "Product Design and Development "McGraw- Hill Education; 7 edition, 2020.

REFERENCES:

1. Belz A., 36-Hour Course: "Product Development" McGraw-Hill, 2010.
2. Rosenthal S.,"Effective Product Design and Development", Business One Orwin,Homewood, 1992,ISBN1-55623-603-4.
3. Pugh.S,"Total Design Integrated Methods for Successful Product Engineering", Addison Wesley Publishing,1991,ISBN0-202-41639-5.
4. Chitale, A. K. and Gupta, R. C., Product Design and Manufacturing, PHI Learning, 2013.
5. Jamnia, A., Introduction to Product Design and Development for Engineers, CRC Press, 2018.

SUSTAINABLE MANAGEMENT

Course Code	24OE910	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				50 Marks	50 Marks

Prerequisite: Basic knowledge of management principles, environmental science, resource management, and sustainable development concepts.

COURSE OBJECTIVES:

1. To provide students with fundamental knowledge of the notion of corporate sustainability.
2. To determine how organizations impacts on the environment and socio-technical systems, the relationship between social and environmental performance and competitiveness, the approaches and methods.

UNIT I MANAGEMENT OF SUSTAINABILITY 9

Management of sustainability -rationale and political trends: An introduction to sustainability management, International and European policies on sustainable development, theoretical pillars in sustainability management studies.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II CORPORATE SUSTAINABILITY AND RESPONSIBILITY 9

Corporate sustainability parameter, corporate sustainability institutional framework, integration of sustainability into strategic planning and regular business practices, fundamentals of stakeholder engagement.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III SUSTAINABILITY MANAGEMENT: STRATEGIES AND APPROACHES 9

Corporate sustainability management and competitiveness: Sustainability-oriented corporate strategies, markets and competitiveness, Green Management between theory and practice, Sustainable Consumption and Green Marketing strategies, Environmental regulation and strategic postures; Green Management approaches and tools; Green engineering: clean technologies and innovation processes; Sustainable Supply Chain Management and Procurement.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV SUSTAINABILITY AND INNOVATION **9**

Socio-technical transitions and sustainability, Sustainable entrepreneurship, Sustainable pioneers in green market niches, Smart communities and smart specializations.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT V SUSTAINABLE MANAGEMENT OF RESOURCES, COMMODITIES AND COMMONS **9**

Energy management, Water management, Waste management, Wild Life Conservation, Emerging trends in sustainable management, Case Studies.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

TOTAL: 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: An understanding of sustainability management as an approach to aid in evaluating and minimizing environmental impacts while achieving the expected social impact.

CO2: An understanding of corporate sustainability and responsible Business Practices

CO3: Knowledge and skills to understand, to measure and interpret sustainabilityperformances.

CO4: Knowledge of innovative practices in sustainable business and community management

CO5: Deep understanding of sustainable management of resources and commodities

REFERENCES:

1. Daddi, T., Iraldo, F., Testa, Environmental Certification for Organizations and Products: Management, 2015
2. Christian N. Madu, Handbook of Sustainability Management 2012
3. Petra Molthan-Hill, The Business Student's Guide to Sustainable Management: Principles and Practice, 2014
4. Margaret Robertson, Sustainability Principles and Practice, 2014
5. Peter Rogers, An Introduction to Sustainable Development, 2006

MICRO AND SMALL BUSINESS MANAGEMENT

Course Code	24OE911	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of business management, entrepreneurship, finance, and organizational concepts.

COURSE OBJECTIVES: To impart the knowledge of

1. To familiarize students with the theory and practice of small business management.
2. To learn the legal issues faced by small business and how they impact operations.

UNIT I INTRODUCTION TO SMALL BUSINESS 9

Creation, Innovation, entrepreneurship and small business - Defining Small Business –Role of Owner – Manager – government policy towards small business sector –elements of entrepreneurship –evolution of entrepreneurship –Types of Entrepreneurship – social, civic, corporate - Business life cycle - barriers and triggers to new venture creation – process to assist start ups – small business and family business.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II SCREENING THE BUSINESS OPPORTUNITY AND FORMULATING THE BUSINESS PLAN 9

Concepts of opportunity recognition; Key factors leading to new venture failure; New venture screening process; Applying new venture screening process to the early stage small firm Role

planning in small business – importance of strategy formulation – management skills for small business creation and development.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III BUILDING THE RIGHT TEAM AND MARKETING STRATEGY 9

Management and Leadership – employee assessments – Tuckman's stages of group development - The entrepreneurial process model - Delegation and team building - Comparison of HR management in small and large firms - Importance of coaching and how to apply a coaching model. Marketing within the small business - success strategies for small business marketing - customer delight and business generating systems, - market research, - assessing market performance- sales management and strategy - the marketing mix and marketing strategy.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV FINANCING SMALL BUSINESS 9

Main sources of entrepreneurial capital; Nature of 'bootstrap' financing - Difference between cash and profit - Nature of bank financing and equity financing - Funding-equity gap for small firms. Importance of working capital cycle - Calculation of break-even point - Power of gross profit margin- Pricing for profit - Credit policy issues and relating these to cash flow management and profitability.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V VALUING SMALL BUSINESS AND CRISIS MANAGEMENT 9

Causes of small business failure - Danger signals of impending trouble - Characteristics of poorly performing firms - Turnaround strategies - Concept of business valuation - Different valuation measurements - Nature of goodwill and how to measure it - Advantages and disadvantages of buying an established small firm - Process of preparing a business for sale.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL: 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES

CO1. Familiarise the students with the concept of small business
CO2. In depth knowledge on small business opportunities and challenges
CO3. Ability to devise plans for small business by building the right skills and marketing strategies
CO4. Identify the funding source for small start ups
CO5. Business evaluation for buying and selling of small firms

REFERENCES

1. Hankinson,A.(2000). "The key factors in the profile of small firm owner-managers that influence business performance. The South Coast Small Firms Survey, 1997-2000." Industrial and Commercial Training 32(3):94-98.
2. Parker,R.(2000). "Small is not necessarily beautiful: An evaluation of policy support for small and medium-sized enterprise in Australia." Australian Journal of Political Science 35(2):239-253.
3. Journal articles on SME's.

INTELLECTUAL PROPERTY RIGHTS

Course Code	24OE912	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of legal systems, innovation, research, and technology management concepts

COURSE OBJECTIVE:

1. To understand intellectual property rights and its valuation.

UNIT I INTRODUCTION **9**

Intellectual property rights - Introduction, Basic concepts, Patents, Copyrights, Trademarks, Trade Secrets, Geographic Indicators; Nature of Intellectual Property, Technological Research, Inventions and Innovations, History - the way from WTO to WIPO, TRIPS.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II PROCESS **9**

New Developments in IPR, Procedure for grant of Patents, TM, GIs, Patenting under Patent Cooperation Treaty, Administration of Patent system in India, Patenting in foreign countries.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III STATUTES **9**

International Treaties and conventions on IPRs, The TRIPs Agreement, PCT Agreement, The Patent Act of India, Patent Amendment Act (2005), Design Act, Trademark Act, Geographical Indication Act, Bayh- Dole Act and Issues of Academic Entrepreneurship.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV STRATEGIES IN INTELLECTUAL PROPERTY **9**

Strategies for investing in R&D, Patent Information and databases, IPR strength in India, Traditional Knowledge, Case studies.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V MODELS **9**

The technologies Know-how, concept of ownership, Significance of IP in Value Creation, IP Valuation and IP Valuation Models, Application of Real Option Model in Strategic Decision Making, Transfer and Licensing.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

TOTAL: 45

COURSE OUTCOMES

CO1: Understanding of intellectual property and appreciation of the need to protect it

CO2: Awareness about the process of patenting

CO3: Understanding of the statutes related to IPR

CO4: Ability to apply strategies to protect intellectual property

CO5: Ability to apply models for making strategic decisions related to IPR

REFERENCES

1. Sople Vinod, Managing Intellectual Property by (Prentice hall of India Pvt.Ltd), 2006.
2. Intellectual Property rights and copyrights, EssEss Publications.
3. Primer, R. Anita Rao and Bhanoji Rao, Intellectual Property Rights, Lastain Book company. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2006.
4. WIPO Intellectual Property Hand book.

ETHICAL MANAGEMENT

Course Code	24OE913	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of management principles, organizational behavior, and professional ethics.

COURSE OBJECTIVE:

1. To help students develop knowledge and competence in ethical management and decision making in organizational contexts.

UNIT I ETHICS AND SOCIETY **9**

Ethical Management- Definition, Motivation, Advantages-Practical implications of ethical management. Managerial ethics, professional ethics, and social Responsibility-Role of culture and society's expectations- Individual and organizational responsibility to society and the community.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II ETHICAL DECISION MAKING AND MANAGEMENT IN A CRISIS **9**

Managing in an ethical crisis, the nature of a crisis, ethics in crisis management, discuss case studies, analyze real-world scenarios, develop ethical management skills, knowledge, and competencies. Proactive crisis management.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III STAKEHOLDERS IN ETHICAL MANAGEMENT **9**

Stakeholders in ethical management, identifying internal and external stakeholders, nature of stakeholders, ethical management of various kinds of stakeholders: customers (product and service issues), employees (leadership, fairness, justice, diversity) suppliers, collaborators, business, community, the natural environment (the sustainability imperative, green management, Contemporary issues).

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT IV INDIVIDUAL VARIABLES IN ETHICAL MANJAGEMENT 9

Understanding individual variables in ethics, managerial ethics, concepts in ethical psychology-ethical awareness, ethical courage, ethical judgment, ethical foundations, ethical emotions/intuitions/intensity. Utilization of these concepts and competencies for ethical decision-making and management.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT V PRACTICAL FIELD-GUIDE, TECHNIQUES AND SKILLS 9

Ethical management in practice, development of techniques and skills, navigating challenges and dilemmas, resolving issues and preventing unethical management proactively. Role modelling and creating a culture of ethical management and human flourishing.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

TOTAL: 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES

CO1: Role modelling and influencing the ethical and cultural context.
CO2: Respond to ethical crises and proactively address potential crises situations.
CO3: Understand and implement stakeholder management decisions.
CO4: Develop the ability, knowledge, and skills for ethical management.
CO5: Develop practical skills to navigate, resolve and thrive in management situations

REFERENCES

1. Brad Agle, Aaron Miller, Bill O' Rourke, The Business Ethics Field Guide: the essential companion to leading your career and your company, 2016.

2. Steiner & Steiner, Business, Government & Society: A managerial Perspective, 2011.

3. Lawrence & Weber, Business and Society: Stakeholders, Ethics, Public Policy, 2020.

IoT FOR SMART SYSTEMS

Course Code	24OE914	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of sensors, embedded systems, computer networks, programming, and wireless communication concepts.

COURSE OBJECTIVES:

1. To study about **Internet of Things** technologies and its role in real time applications.
2. To introduce the infrastructure required for IoT
3. To familiarize the accessories and communication techniques for IoT.
4. To provide insight about the embedded processor and sensors required for IoT
5. To familiarize the different platforms and Attributes for IoT

UNIT I INTRODUCTION TO INTERNET OF THINGS 9

Overview, Hardware and software requirements for IOT, Sensor and actuators, Technology drivers, Business drivers, Typical IoT applications, Trends and implications.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II IOT ARCHITECTURE 9

IoT reference model and architecture -Node Structure - Sensing, Processing, Communication, Powering, Networking - Topologies, Layer/Stack architecture**,** IoT standards, Cloud computing for IoT, Bluetooth, Bluetooth Low Energy beacons.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT 9

PROTOCOLS:

NFC, SCADA and RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe GSM, CDMA,LTE, GPRS, small cell. **Wireless technologies for IoT:** WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary systems-Recent trends.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT IV IOT PROCESSORS **9**

Services/Attributes: Big-Data Analytics for IOT, Dependability,Interoperability, Security, Maintainability.

Embedded processors for IOT :Introduction to Python programming -Building IOT with RASPERRY PI and Arduino.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT V CASE STUDIES **9**

Industrial IoT, Home Automation, smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IOT Defense

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

TOTAL: 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

At the end of this course, the students will have the ability to

CO1: Analyze the concepts of IoT and its present developments.

CO2: Compare and contrast different platforms and infrastructures available for IoT

CO3: Explain different protocols and communication technologies used in IoT

CO4: Analyze the big data analytic and programming of IoT

CO5: Implement IoT solutions for smart applications

REFERENCES:

1. ArshdeepBahga and VijaiMadisetti : A Hands-on Approach “Internet of Things”,Universities Press 2015.
2. Oliver Hersent , David Boswarthick and Omar Elloumi “ The Internet of Things”, Wiley,2016.
3. Samuel Greengard, “ The Internet of Things”, The MIT press, 2015.
4. Adrian McEwen and Hakim Cassimally“Designing the Internet of Things “Wiley,2014.
5. Jean- Philippe Vasseur, Adam Dunkels, “Interconnecting Smart Objects with IP: The Next Internet” Morgan Kuffmann Publishers, 2010.
6. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, John Wiley and sons, 2014.
7. Lingyang Song/DusitNiyato/ Zhu Han/ Ekram Hossain,” Wireless Device-to-Device Communications and Networks, CAMBRIDGE UNIVERSITY PRESS,2015.
8. OvidiuVermesan and Peter Friess (Editors), “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers Series in Communication, 2013.
9. Vijay Madisetti , ArshdeepBahga, “Internet of Things (A Hands on-Approach)”, 2014.
10. Zach Shelby, Carsten Bormann, “6LoWPAN: The Wireless Embedded Internet”, John Wiley and sons, 2009.
11. Lars T.Berger and Krzysztof Iniewski, “Smart Grid applications, communications and security”, Wiley, 2015.
12. JanakaEkanayake, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama and Nick Jenkins, “ Smart Grid Technology and Applications”, Wiley, 2015.
13. UpenaDalal,”Wireless Communications & Networks,Oxford,2015.

MACHINE LEARNING AND DEEP LEARNING

Course Code	24OE915	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of programming, linear algebra, probability, statistics, and artificial intelligence concepts.

COURSE OBJECTIVES:

1. Understanding about the learning problem and algorithms
2. Providing insight about neural networks
3. Introducing the machine learning fundamentals and significance
4. Enabling the students to acquire knowledge about pattern recognition.
5. Motivating the students to apply deep learning algorithms for solving real life problems.

UNIT I LEARNING PROBLEMS AND ALGORITHMS 9

Various paradigms of learning problems, Supervised, Semi-supervised and Unsupervised algorithms

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II NEURAL NETWORKS 9

Differences between Biological and Artificial Neural Networks - Typical Architecture, Common Activation Functions, Multi-layer neural network, Linear Separability, Hebb Net, Perceptron, Adaline, Standard Back propagation Training Algorithms for Pattern Association - Hebb rule and Delta rule, Hetero associative, Auto associative, Kohonen Self Organising Maps, Examples of Feature Maps, Learning Vector Quantization, Gradient descent, Boltzmann Machine Learning.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III MACHINE LEARNING – FUNDAMENTALS & FEATURE SELECTIONS & CLASSIFICATIONS 9

Classifying Samples: The confusion matrix, Accuracy, Precision, Recall, F1- Score, the curse of dimensionality, training, testing, validation, cross validation, overfitting, under-fitting the data, early stopping, regularization, bias and variance. Feature Selection, normalization, dimensionality reduction, Classifiers: KNN, SVM, Decision trees, Naïve Bayes, Binary classification, multi class classification, clustering.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV DEEP LEARNING: CONVOLUTIONAL NEURAL NETWORKS 9

Feed forward networks, Activation functions, back propagation in CNN, optimizers, batch normalization, convolution layers, pooling layers, fully connected layers, dropout, Examples of CNNs.

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT V DEEP LEARNING: RNNS, AUTOENCODERS AND GANS 9

State, Structure of RNN Cell, LSTM and GRU, Time distributed layers, Generating Text, Autoencoders: Convolutional Autoencoders, Denoising autoencoders, Variational autoencoders, GANs: The discriminator, generator, DCGANs

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

TOTAL : 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES (CO):

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

CO1 : Illustrate the categorization of machine learning algorithms.

CO2: Compare and contrast the types of neural network architectures, activation functions

CO3: Acquaint with the pattern association using neural networks

CO4: Elaborate various terminologies related with pattern recognition and architectures of convolutional neural networks

CO5: Construct different feature selection and classification techniques and advanced neural network architectures such as RNN, Autoencoders, and GANs.

REFERENCES:

1. J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro Fuzzy and Soft Computing - A Computational Approach to Learning and Machine Intelligence, 2012, PHI learning
2. Deep Learning, Ian Good fellow, YoshuaBengio and Aaron Courville, MIT Press, ISBN: 9780262035613, 2016.
3. The Elements of Statistical Learning. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Second Edition. 2009.
4. Pattern Recognition and Machine Learning. Christopher Bishop. Springer. 2006.
5. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017.

RENEWABLE ENERGY TECHNOLOGY

Course Code	24OE916	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of energy resources, electrical systems, thermodynamics, and environmental science.

OBJECTIVES:

To impart knowledge on

1. Different types of renewable energy technologies
2. Standalone operation, grid connected operation of renewable energy systems

UNIT I INTRODUCTION 9

Classification of energy sources – Co2 Emission - Features of Renewable energy - Renewable energy scenario in India -Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment Per Capital Consumption - CO2 Emission -importance of renewable energy sources, Potentials – Achievements– Applications.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II SOLAR PHOTOVOLTAICS 9

Solar Energy: Sun and Earth-Basic Characteristics of solar radiation- angle of sunrays on solar collector-Estimating Solar Radiation Empirically - Equivalent circuit of PV Cell- Photovoltaic cell- characteristics: P-V and I-V curve of cell-Impact of Temperature and Insolation on I-V characteristics- Shading Impacts on I-V characteristics-Bypass diode -Blocking diode.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III PHOTOVOLTAIC SYSTEM DESIGN 9

Block diagram of solar photo voltaic system : Line commutated converters (inversion mode) - Boost and buck-boost converters - selection of inverter, battery sizing, array sizing - PV systems classification-standalone PV systems - Grid tied and grid interactive inverters- grid connection issues.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV WIND ENERGY CONVERSION SYSTEMS 9

Origin of Winds: Global and Local Winds- Aerodynamics of Wind turbine-Derivation of Betz's limit-Power available in wind-Classification of wind turbine: Horizontal Axis wind turbine and Vertical axis wind turbine- Aerodynamic Efficiency-Tip Speed-Tip Speed Ratio-Solidity-Blade Count-Power curve of wind turbine - Configurations of wind energy conversion systems: Type A, Type B, Type C and Type D Configurations- Grid connection Issues - Grid integrated SCIG and PMSG based WECS.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V OTHER RENEWABLE ENERGY SOURCES 9

Qualitative study of different renewable energy resources: ocean, Biomass, Hydrogen energy systems, Fuel cells, Ocean Thermal Energy Conversion (OTEC), Tidal and wave energy, Geothermal Energy Resources.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

OUTCOMES:

After completion of this course, the student will be able to:

CO1: Demonstrate the need for renewable energy sources.
CO2: Develop a stand-alone photo voltaic system and implement a maximum power point tracking in the PV system.
CO3: Design a stand-alone and Grid connected PV system.
CO4: Analyze the different configurations of the wind energy conversion systems. CO5: Realize the basic of various available renewable energy sources

REFERENCES:

1. S.N.Bhadra, D. Kastha, & S. Banerjee "Wind Electrical Systems", Oxford UniversityPress, 2009.
2. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.
3. Rai. G.D," Solar energy utilization", Khanna publishes, 1993.
4. Chetan Singh Solanki, "Solar Photovoltaics: Fundamentals, Technologies and Applications", PHI Learning Private Limited, 2012.
5. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006
6. Gray, L. Johnson, "Wind energy system", prentice hall of India, 1995.
7. B.H.Khan, " Non-conventional Energy sources", , McGraw-hill, 2nd Edition, 2009.
8. Fang Lin Luo Hong Ye, " Renewable Energy systems", Taylor & Francis Group,2013.

SMART GRID

Course Code	24OE917	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of electrical power systems, power electronics, communication networks, and control systems.

COURSE OBJECTIVES

1. To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
2. To know about the function of smart grid.
3. To familiarize the power quality management issues in Smart Grid.
4. To familiarize the high performance computing for Smart Grid applications
5. To get familiarized with the communication networks for Smart Grid applications

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Comparison of Micro grid and Smart grid, Present development & International policies in Smart Grid, Smart Grid Initiative for Power Distribution Utility in India – Case Study.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers, Smart Integration of energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV) – Grid to Vehicle and Vehicle to Grid charging concepts.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU) & their application for monitoring & protection. Demand side management and demand response programs, Demand pricing and Time of Use, Real Time Pricing, Peak Time Pricing.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

Unit V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Architecture and Standards -Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), PLC, Zigbee, GSM, IP based Protocols, Basics of Web Service and CLOUD Computing, Cyber Security for Smart Grid.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL : 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOME:

Students able to

CO1: Relate with the smart resources, smart meters and other smart devices.

CO2: Explain the function of Smart Grid.

CO3: Experiment the issues of Power Quality in Smart Grid.

CO4: Analyze the performance of Smart Grid.

CO5**:** Recommend suitable communication networks for smart grid applications

REFERENCES

1. Stuart Borlase 'Smart Grid: Infrastructure, Technology and Solutions', CRC Press 2012.
2. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, 'Smart Grid: Technology and Applications', Wiley, 2012.

3. Mini S. Thomas, John D McDonald, ‘Power System SCADA and Smart Grids’, CRC Press, 2015
4. Kenneth C.Budka, Jayant G. Deshpande, Marina Thottan, ‘Communication Networks for SmartGrids’, Springer, 2014
5. SMART GRID Fundamentals of Design and Analysis, James Momoh, IEEE press, A John Wiley & Sons, Inc., Publication.

BIG DATA ANALYTICS

Course Code	24OE918	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of databases, programming, statistics, data structures, and data processing concepts.

COURSE OBJECTIVES:

1. To understand the basics of big data analytics
2. To understand the search methods and visualization
3. To learn mining data streams
4. To learn frameworks
5. To gain knowledge on R language

UNIT I **INTRODUCTION TO BIG DATA** **9**

Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis Vs Reporting - Modern Data Analytic Tools- Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II **SEARCH METHODS AND VISUALIZATION** **9**

Search by simulated Annealing – Stochastic, Adaptive search by Evaluation – Evaluation Strategies –Genetic Algorithm – Genetic Programming – Visualization – Classification of Visual Data Analysis Techniques – Data Types – Visualization Techniques – Interaction techniques – Specific Visual data analysis Techniques

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III **MINING DATA STREAMS** **9**

Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV FRAMEWORKS **9**

MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed File Systems – Case Study- Preventing Private Information Inference Attacks on Social Networks- Grand Challenge: Applying Regulatory Science and Big Data to Improve Medical Device Innovation

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V R LANGUAGE **9**

Overview, Programming structures: Control statements -Operators -Functions -Environment and scope issues -Recursion -Replacement functions, R data structures: Vectors -Matrices and arrays - Lists -Data frames -Classes, Input/output, String manipulations

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1:understand the basics of big data analytics
CO2: Ability to use Hadoop, Map Reduce Framework.
CO3: Ability to identify the areas for applying big data analytics for increasing the business outcome.
CO4:gain knowledge on R language
CO5: Contextually integrate and correlate large amounts of information to gain faster insights.

TOTAL:45

REFERENCE:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 3rd edition 2020.
3. Norman Matloff, The Art of R Programming: A Tour of Statistical Software Design, No Starch Press, USA, 2011.
4. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & sons, 2012.
5. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007.

INTERNET OF THINGS AND CLOUD

Course Code	24OE919	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of computer networks, cloud computing, embedded systems, sensors, and programming fundamentals**.**

COURSE OBJECTIVES:

1. To understand Smart Objects and IoT Architectures
2. To learn about various IOT-related protocols
3. To build simple IoT Systems using Arduino and Raspberry Pi.
4. To understand data analytics and cloud in the context of IoT
5. To develop IoT infrastructure for popular applications

UNIT I FUNDAMENTALS OF IoT 9

Introduction to IoT – IoT definition – Characteristics – IoT Complete Architectural Stack – IoT enabling Technologies – IoT Challenges. Sensors and Hardware for IoT – Hardware Platforms – Arduino, Raspberry Pi, Node MCU. A Case study with any one of the boards and data acquisition from sensors.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II PROTOCOLS FOR IoT 9

Infrastructure protocol (IPV4/V6/RPL), Identification (URIs), Transport (Wifi, Lifi, BLE), Discovery, Data Protocols, Device Management Protocols. – A Case Study with MQTT/CoAP usage- IoT privacy, security and vulnerability solutions.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III CASE STUDIES/INDUSTRIAL APPLICATIONS 9

Case studies with architectural analysis: IoT applications – Smart City – Smart Water – Smart Agriculture – Smart Energy – Smart Healthcare – Smart Transportation – Smart Retail – Smart waste management.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV CLOUD COMPUTING INTRODUCTION 9

Introduction to Cloud Computing - Service Model – Deployment Model- Virtualization Concepts – Cloud Platforms – Amazon AWS – Microsoft Azure – Google APIs.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V IoT AND CLOUD 9

IoT and the Cloud - Role of Cloud Computing in IoT - AWS Components - S3 – Lambda - AWS IoT Core -Connecting a web application to AWS IoT using MQTT- AWS IoT Examples. Security Concerns, Risk Issues, and Legal Aspects of Cloud Computing- Cloud Data Security

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL:45

COURSE OUTCOMES:

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

CO1: Understand the various concept of the IoT and their technologies..
CO2: Develop IoT application using different hardware platforms
CO3: Implement the various IoT Protocols
CO4: Understand the basic principles of cloud computing.
CO5: Develop and deploy the IoT application into cloud environment

REFERENCES

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman ,CRC Press, 2017
2. Adrian McEwen, Designing the Internet of Things, Wiley,2013.
3. EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley publishers, 2015.
4. Simon Walkowiak, “Big Data Analytics with R” PackT Publishers, 2016
5. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, Wiley Publishers, 2015.

MEDICAL ROBOTICS

Course Code	24OE920	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of robotics, sensors, control systems, embedded systems, and biomedical engineering concepts.

COURSE OBJECTIVES:

1. To explain the basic concepts of robots and types of robots
2. To discuss the designing procedure of manipulators, actuators and grippers
3. To impart knowledge on various types of sensors and power sources
4. To explore various applications of Robots in Medicine
5. To impart knowledge on wearable robots

UNIT I INTRODUCTION TO ROBOTICS 9

Introduction to Robotics, Overview of robot subsystems, Degrees of freedom, configurations and concept of workspace, Dynamic Stabilization

Sensors and Actuators

Sensors and controllers, Internal and external sensors, position, velocity and acceleration sensors, Proximity sensors, force sensors Pneumatic and hydraulic actuators, Stepper motor control circuits, End effectors, Various types of Grippers, PD and PID feedback actuator models

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT II MANIPULATORS & BASIC KINEMATICS 9

Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and pneumatic manipulator, Forward Kinematic Problems, Inverse Kinematic Problems, Solutions of Inverse Kinematic problems

Navigation and Treatment Planning

Variable speed arrangements, Path determination – Machinery vision, Ranging – Laser – Acoustic, Magnetic, fiber optic and Tactile sensor

Teaching-Learning Process **Pedagogy:** Lecture, PPT

RBT Level: L1- L3

UNIT III SURGICAL ROBOTS **9**

Da Vinci Surgical System, Image guided robotic systems for focal ultrasound based surgical applications, System concept for robotic Tele-surgical system for off-pump, CABG surgery, Urologic applications, Cardiac surgery, Neuro-surgery, Pediatric and General Surgery, Gynecologic Surgery, General Surgery and Nanorobotics. Case Study

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV REHABILITATION AND ASSISTIVE ROBOTS **9**

Pediatric Rehabilitation, Robotic Therapy for the Upper Extremity and Walking, Clinical-Based Gait Rehabilitation Robots, Motion Correlation and Tracking, Motion Prediction, Motion Replication. Portable Robot for Tele rehabilitation, Robotic Exoskeletons – Design considerations, Hybrid assistive limb. Case Study

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V WEARABLE ROBOTS **9**

Augmented Reality, Kinematics and Dynamics for Wearable Robots, Wearable Robot technology, Sensors, Actuators, Portable Energy Storage, Human–robot cognitive interaction (cHRI), Human– robot physical interaction (pHRI), Wearable Robotic Communication - case study

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL:45 PERIODS

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

CO1: Describe the configuration, applications of robots and the concept of grippers and actuators

CO2: Explain the functions of manipulators and basic kinematics

CO3: Describe the application of robots in various surgeries

CO4: Design and analyze the robotic systems for rehabilitation

CO5: Design the wearable robots

REFERENCES

1. Nagrath and Mittal, "Robotics and Control", Tata McGraw Hill, First edition, 2003
2. Spong and Vidhyasagar, "Robot Dynamics and Control", John Wiley and Sons, First edition, 2008
3. Fu.K.S, Gonzalez. R.C., Lee, C.S.G, "Robotics, control", sensing, Vision and Intelligence, Tata McGraw Hill International, First edition, 2008
4. Bruno Siciliano, Oussama Khatib, Springer Handbook of Robotics, 1st Edition, Springer, 2008
5. Shane (S.Q.) Xie, Advanced Robotics for Medical Rehabilitation - Current State of the Art and Recent Advances, Springer, 2016
6. Sashi S Kommu, Rehabilitation Robotics, I-Tech Education and Publishing, 2007
7. Jose L. Pons, Wearable Robots: Biomechatronic Exoskeletons, John Wiley & Sons Ltd, England, 2008
8. Howie Choset, Kevin Lynch, Seth Hutchinson, "Principles of Robot Motion: Theory, Algorithms, and Implementations", Prentice Hall of India, First edition, 2005
9. Philippe Coiffet, Michel Chirouze, "An Introduction to Robot Technology", Tata McGraw Hill, First Edition, 1983
10. Jacob Rosen, Blake Hannaford & Richard M Satava, "Surgical Robotics: System Applications & Visions", Springer 2011
11. Jocelyn Troccaz, Medical Robotics, Wiley, 2012
12. Achim Schweikard, Floris Ernst, Medical Robotics, Springer, 2015

EMBEDDED AUTOMATION

Course Code	24OE921	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of embedded systems, microcontrollers, sensors, control systems, and programming fundamentals.

COURSE OBJECTIVES: To impart the knowledge of

1. To learn about the process involved in the design and development of real-time embedded system
2. To develop the embedded C programming skills on 8-bit microcontroller
3. To study about the interfacing mechanism of peripheral devices with 8-bit microcontrollers
4. To learn about the tools, firmware related to microcontroller programming
5. To build a home automation system

UNIT - I INTRODUCTION TO EMBEDDED C PROGRAMMING 9

C Overview and Program Structure - C Types, Operators and Expressions - C Control Flow - C Functions and Program Structures - C Pointers And Arrays - FIFO and LIFO - C Structures - Development Tools

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT - II AVR MICROCONTROLLER 9

ATMEGA 16 Architecture - Nonvolatile and Data Memories - Port System - Peripheral Features : Time Base, Timing Subsystem, Pulse Width Modulation, USART, SPI, Two Wire Serial Interface, ADC, Interrupts - Physical and Operating Parameters

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT – III HARDWARE AND SOFTWARE INTERFACING WITH 8-BIT SERIES CONTROLLERS 9

Lights and Switches - Stack Operation - Implementing Combinational Logic - Expanding I/O - Interfacing Analog To Digital Convertors - Interfacing Digital To Analog Convertors - LED Displays : Seven Segment Displays, Dot Matrix Displays - LCD Displays - Driving Relays - Stepper Motor Interface - Serial EEPROM - Real Time Clock - Accessing Constants Table - Arbitrary Waveform Generation - Communication Links - System Development Tools

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT – IV VISION SYSTEM **9**

Fundamentals of Image Processing - Filtering - Morphological Operations - Feature Detection and Matching - Blurring and Sharpening - Segmentation - Thresholding - Contours - Advanced Contour Properties - Gradient - Canny Edge Detector - Object Detection - Background Subtraction

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT – V HOME AUTOMATION **9**

Home Automation - Requirements - Water Level Notifier - Electric Guard Dog - Tweeting Bird Feeder - Package Delivery Detector - Web Enabled Light Switch - Curtain Automation - Android Door Lock - Voice Controlled Home Automation - Smart Lighting - Smart Mailbox - Electricity Usage Monitor - Proximity Garage Door Opener - Vision Based Authentic Entry System

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL: 45

Suggested Activities : Case study, MCQ, Assignment / Explanation and report submission, Content quality, Review of Gate questions**.**

Evaluation Methods: Performance in Suggested activities, IAT and End Semester Examinations

COURSE OUTCOMES:

On successful completion of this course, students will be able to

CO1: Analyze The 8-Bit Series Microcontroller Architecture, Features And Pin Details

CO2: Write embedded C programs for embedded system application

CO3: Design and develop real time systems using AVR microcontrollers

CO4: Design and develop the systems based on vision mechanism

CO5: Design and develop a real time home automation system

REFERENCES:

1. Dhananjay V. Gadre, "Programming and Customizing the AVR Microcontroller", McGraw-Hill, 2001.
2. Joe Pardue, "C Programming for Microcontrollers ", Smiley Micros, 2005.
3. Steven F. Barrett, Daniel J. Pack, "ATMEL AVR Microcontroller Primer : Programming and Interfacing", Morgan & Claypool Publishers, 2012
4. Mike Riley, "Programming Your Home - Automate With Arduino, Android and Your Computer", the Pragmatic Programmers, Llc, 2012.
5. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2011.

6. Kevin P. Murphy, "Machine Learning - a Probabilistic Perspective", the MIT Press Cambridge, Massachusetts, London, 2012.

ENVIRONMENTAL SUSTAINABILITY

Course Code	24OE922	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of environmental science, ecology, natural resources, and sustainable development concepts.

Course Objectives : To impart the knowledge of

1. To understand the principles and importance of environmental sustainability and sustainable development.
2. To study environmental challenges such as climate change, pollution, biodiversity loss, and resource depletion.
3. To develop knowledge of sustainable resource management, conservation practices, and environmental protection strategies.
4. To analyze the environmental, social, and economic dimensions of sustainability in decision-making.
5. To promote responsible environmental practices and sustainable solutions for global and local environmental issues.

UNIT I INTRODUCTION 9

Valuing the Environment: Concepts, Valuing the Environment: Methods, Property Rights, Externalities, and Environmental Problems

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II CONCEPT OF SUSTAINABILITY 9

Sustainable Development: Defining the Concept, the Population Problem, Natural Resource Economics: An Overview, Energy, Water, Agriculture

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III SIGNIFICANCE OF BIODIVERSITY 9

Biodiversity, Forest Habitat, Commercially Valuable Species, Stationary - Source Local Air

Pollution, Acid Rain and Atmospheric Modification, Transportation

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV POLLUTION IMPACTS **9**

Water Pollution, Solid Waste and Recycling, Toxic Substances and Hazardous Wastes, Global Warming.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V ENVIRONMENTAL ECONOMICS **9**

Development, Poverty, and the Environment, Visions of the Future, Environmental economics and policy by Tom Tietenberg, Environmental Economics

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL : 45

REFERENCES

1. Andrew Hoffman, Competitive Environmental Strategy - A Guide for the Changing Business Landscape, Island Press.
2. Stephen Doven, Environment and Sustainability Policy: Creation, Implementation, Evaluation, the Federation Press, 2005
3. Robert Brinkmann., Introduction to Sustainability, Wiley-Blackwell., 2016
4. Niko Roorda., Fundamentals of Sustainable Development, 3rd Edn, Routledge, 2020
5. Bhavik R Bakshi., Sustainable Engineering: Principles and Practice, Cambridge University Press, 2019

TEXTILE REINFORCED COMPOSITES

Course Code	24OE923	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of engineering materials, mechanics of materials, manufacturing processes, and material science concepts.

Course Objectives: To impart the knowledge of

1. To understand the fundamentals of textile reinforced composites and their constituent materials.
2. To study various textile reinforcement forms, fabrication techniques, and manufacturing processes used in composite structures.
3. To analyze the mechanical behavior, properties, and performance of textile reinforced composites.
4. To evaluate the applications of textile composites in aerospace, automotive, civil, and industrial sectors.
5. To explore recent developments, testing methods, and future trends in textile reinforced composite technology.

UNIT I REINFORCEMENTS 9

Introduction – composites –classification and application; reinforcements- fibres and its properties; preparation of reinforced materials and quality evaluation; preforms for various composites

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II MATRICES 9

Preparation, chemistry, properties and applications of thermoplastic and thermoset resins; mechanism of interaction of matrices and reinforcements; optimization of matrices

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III COMPOSITE MANUFACTURING 9

Classification; methods of composites manufacturing for both thermoplastics and thermosets- Hand layup, Filament Winding, Resin transfer moulding, prepregs and autoclave moulding, pultrusion, vacuum impregnation methods, compression moulding; post processing of composites and composite design requirements

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV TESTING **9**

Fibre volume and weight fraction, specif ic gravity of composites, tensile, f lexural, impact, compression, inter laminar shear stress and fatigue properties of thermoset and thermoplastic composites.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V MECHANICS **9**

Micro mechanics, macro mechanics of single layer, macro mechanics of laminate, classical lamination theory, failure theories and prediction of inter laminar stresses using at ware

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL: 45

REFERENCES

1. BorZ.Jang,"Advanced Polymer composites",ASM International,USA,1994.
2. Carlsson L.A. and Pipes R.B., "Experimental Characterization of advanced composite Materials",SecondEdition,CRCPress,NewJersey,1996.
3. George LubinandStanley T.Peters, "Handbook of Composites", Springer Publications,1998.
4. Mel. M. Schwartz, "Composite Materials", Vol. 1 &2, Prentice Hall PTR, New Jersey,1997.
5. RichardM.Christensen,"Mechanics of compositematerials",DoverPublications,2005.
6. Sanjay K. Mazumdar, "Composites Manufacturing: Materials, Product, and Process Engineering",CRCPress,2001

NANOCOMPOSITE MATERIALS

Course Code	24OE924	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of material science, chemistry, engineering materials, and composite materials.

Course Objectives: To impart the knowledge of

1. To understand the fundamentals, classification, and properties of nanocomposite materials.
2. To study the synthesis, processing, and characterization techniques of nanocomposites.
3. To analyze the influence of nanoscale reinforcements on the mechanical, thermal, electrical, and functional properties of composites.
4. To evaluate the applications of nanocomposite materials in engineering, electronics, biomedical, and energy sectors.
5. To explore recent advancements, challenges, and future trends in nanocomposite material development.

UNIT I BASICS OF NANOCOMPOSITES 9

Nomenclature, Properties, features and processing of nanocomposites. Sample Preparation and Characterization of Structure and Physical properties. Designing, stability and mechanical properties and applications of super hard nanocomposites.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II METAL BASED NANOCOMPOSITES 9

Metal-metal nanocomposites, some simple preparation techniques and their properties. Metal Oxide or Metal-Ceramic composites, Different aspects of their preparation techniques and their final properties and functionality. Fractal based glass-metal nanocomposites, its designing and fractal dimension analysis. Core-Shell structured nanocomposites

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III POLYMER BASED NANOCOMPOSITES 9

Preparation and characterization of diblock Copolymer based nanocomposites; Polymer Carbon nanotubes based composites, their mechanical properties, and industrial possibilities.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT IV NANOCOMPOSITE FROM BIOMATERIALS 9

Natural nanocomposite systems - spider silk, bones, shells; organic-inorganic nanocomposite formation through self-assembly. Biomimetic synthesis of nanocomposites material; Use of synthetic nanocomposites for bone, teeth replacement.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT V NANOCOMPOSITE TECHNOLOGY 9

Nanocomposite membrane structures- Preparation and applications. Nanotechnology in Textiles and Cosmetics-Nano-fillers embedded polypropylene fibers – Soil repellence, Lotus effect - Nano finishing in textiles (UV resistant, anti-bacterial, hydrophilic, self-cleaning, flame retardant finishes), Sun-screen dispersions for UV protection using titanium oxide – Colour cosmetics. Nanotechnology in Food Technology - Nanopackaging for enhanced shelf life - Smart/Intelligent packaging.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL : 45

REFERENCES:

1. Introduction to Nanocomposite Materials. Properties, Processing, Characterization- Thomas E. Twardowski. 2007. DEStech Publications. USA.
2. Nanocomposites Science and Technology - P. M. Ajayan, L.S. Schadler, P. V.Braun 2006.
3. Physical Properties of Carbon Nanotubes- R. Saito 1998.
4. Carbon Nanotubes (Carbon , Vol 33) - M. Endo, S. Iijima, M.S. Dresselhaus 1997.
5. The search for novel, superhard materials- Stan Vepr¡ek (Review Article) JVST A, 1999
6. Nanometer versus micrometer-sized particles-Christian Brosseau, Jamal BeN Youssef, Philippe Talbot, Anne-Marie Konn, (Review Article) J. Appl. Phys, Vol 93, 2003
7. Diblock Copolymer, - Aviram (Review Article), Nature, 2002
8. Bikramjit Basu, Kantesh Balani Advanced Structural Ceramics, A John Wiley & Sons, Inc.,
9. P. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles,Woodhead publication, London, 2006

IPR, BIOSAFETY AND ENTREPRENEURSHIP

Course Code	24OE925	Course Type		THEORY	
Course Offered to	ME-CSE				
Total Teaching Periods	45	L:T:P	3:0:0	Credits	3
Handled by	CSE	Assessment Methods		IAT	ESE
				40 Marks	60 Marks

Prerequisite: Basic knowledge of research methodology, innovation, biotechnology fundamentals, and business management concepts.

Course Objectives: To impart the knowledge of

1. To understand the fundamentals of Intellectual Property Rights (IPR), biosafety regulations, and entrepreneurship.
2. To study various forms of intellectual property protection, including patents, copyrights, trademarks, and industrial designs.
3. To learn biosafety principles, risk assessment procedures, and regulatory frameworks related to biological research and products.
4. To develop entrepreneurial skills for identifying opportunities, planning ventures, and managing innovation-driven enterprises.
5. To explore the role of IPR, biosafety compliance, and entrepreneurship in promoting sustainable technological and business development.

UNIT I IPR **9**

Intellectual property rights – Origin of the patent regime – Early patents act & Indian pharmaceutical industry – Types of patents – Patent Requirements – Application preparation filing and prosecution – Patentable subject matter – Industrial design, Protection of GMO's IP as a factor in R&D,IP's of relevance to biotechnology and few case studies.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT II AGREEMENTS, TREATIES AND PATENT FILING PROCEDURES **9**

History of GATT Agreement – Madrid Agreement – Hague Agreement – WIPO Treaties – Budapest Treaty – PCT – Ordinary – PCT – Conventional – Divisional and Patent of Addition – Specifications – Provisional and complete – Forms and fees Invention in context of "prior art" –

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

Patent databases – Searching International Databases – Country-wise patent searches (USPTO,espacenet(EPO) – PATENT Scope (WIPO) – IPO, etc National & PCT filing procedure – Time frame and cost – Status of the patent applications filed – Precautions while patenting – disclosure/non-disclosure – Financial assistance for patenting – Introduction to existing schemes Patent licensing and agreement Patent infringement – Meaning, scope, litigation, case studies

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

UNIT III BIOSAFETY **9**

Introduction – Historical Backround – Introduction to Biological Safety Cabinets – Primary Containment for Biohazards – Biosafety Levels – Biosafety Levels of Specific Microorganisms – Recommended Biosafety Levels for Infectious Agents and Infected Animals – Biosafety guidelines – Government of India

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3.

UNIT IV GENETICALLY MODIFIED ORGANISMS **9**

Definition of GMOs & LMOs – Roles of Institutional Biosafety Committee – RCGM – GEAC etc. for GMO applications in food and agriculture – Environmental release of GMOs – Risk Analysis – Risk Assessment – Risk management and communication – Overview of National Regulations and relevant International Agreements including Cartegana Protocol.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L

UNIT V ENTREPRENEURSHIP DEVELOPMENT **9**

Introduction – Entrepreneurship Concept – Entrepreneurship as a career – Entrepreneurial personality – Characteristics of successful Entrepreneur – Factors affecting entrepreneurial growth – Entrepreneurial Motivation – Competencies – Mobility – Entrepreneurship Development Programmes (EDP) - Launching Of Small Enterprise - Definition, Characteristics – Relationship between small and large units – Opportunities for an Entrepreneurial career – Role of small enterprise in economic development – Problems of small scale industries – Institutional finance to entrepreneurs - Institutional support to entrepreneurs.

Teaching-Learning Process **Pedagogy:** Lecture, PPT
RBT Level: L1- L3

TOTAL : 45

REFERENCES

1. Bouchoux, D.E., "Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets for the Paralegal", 3rd Edition, Delmar Cengage Learning, 2008.
2. Fleming, D.O. and Hunt, D.L., "Biological Safety: Principles and Practices", 4th Edition, American Society for Microbiology, 2006.
3. Irish, V., "Intellectual Property Rights for Engineers", 2nd Edition, The Institution of Engineering and Technology, 2005.
4. Mueller, M.J., "Patent Law", 3rd Edition, Wolters Kluwer Law & Business, 2009.
5. Young, T., "Genetically Modified Organisms and Biosafety: A Background Paper for Decision- Makers and Others to Assist in Consideration of GMO Issues" 1st Edition, World Conservation Union, 2004.
6. S.S Khanka, "Entrepreneurial Development", S.Chand & Company LTD, New Delhi, 2007.