PROGRAM CURRICULUM

MASTER OF COMPUTER APPLICATIONS

for

MCA TWO YEAR POST GRADUATE PROGRAM

(Applicable for the batches admitted from A.Y. 2024-25)

ADITYA UNIVERSITY

Aditya Nagar, ADB Road, Surampalem - 533 437

VISION & MISSION OF THE UNIVERSITY

VISION :
Aditya University aspires to be a globally recognised academic institution dedicated to quality education, cutting-edge research, and technological service to our country, and envisions itself as a beacon of holistic advancement and long-term impact, remaining dynamic in the ever-changing worlds of society, ecology, and economics..

MISSION:

- Aditya University pushes boundaries to design high-quality curricula and to provide students with a vibrant and relevant education that prepares them for a changing world. Our industry insights and creative teaching methods attempt to equip our students to be lifelong learners.
- Aditya University's learning environment encourages intellectual curiosity, critical thinking, and cooperation, with the goal of providing students with an immersive education that fosters creativity and innovation. Our cutting-edge facilities, interactive classrooms, and supportive faculty aim to motivate students to realise their full potential and contribute to society.
- Aditya University promotes cross-disciplinary inquiry and discovery and leads cutting-edge research and innovation. Through strategic partnerships, research grants, and a dedicated faculty, we aim to advance science, technology, and social sciences and empower students and faculty to conduct transformative research that solves real-world problems and elevates our institution globally.
- Aditya University is committed to producing world-changing business leaders and entrepreneurs through its emphasis on entrepreneurship, mentoring, and business incubation programmes.

VISION & MISSION OF THE DEPARTMENT

VISION:
To nurture skilled professionals who can drive technological innovation, contribute to cutting-edge research, and provide sustainable solutions to real-world challenges, aligning with the dynamic needs of society, ecology, and the economy.

MISSION:

M1 To provide a dynamic curriculum that blends industry insights and fosters lifelong learning, preparing students for an ever-evolving tech landscape.

M2 To encourage creativity and innovation through cutting-edge tools, interactive learning, and supportive faculty, helping students realize their full potential.

M3 To empower students and faculty to engage in cross-disciplinary research that addresses real-world challenges in technology and society.

M4 To nurture future tech leaders and entrepreneurs through mentoring, business incubation, and hands-on project experience.

PROGRAM OUTCOMES (POS)

After successful completion of the program, the Post Graduates will be able to

PO 1 **Foundation Knowledge**: Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.

PO 2 **Problem Analysis**: Identify, review, formulate and analyse problems for primarily focussing on customer requirements using critical thinking frameworks.

PO 3 **Development of Solutions:** Design, develop and investigate problems with as an innovative approach for solutions incorporating ESG/SDG goals.

PO 4 **Modern Tool Usage:** Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.

PO 5 **Individual and Teamwork:** Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.

PO 6 **Project Management and Finance:** Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management.

PO 7 **Ethics:** Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware

PO 8 **Life-Long Learning:** Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

PROGRAM SPECIFIC OUTCOMES (PSOS)

After successful completion of the program, the Post Graduates will be able to

PSO 1 Acquire the skills to design, develop, and deploy efficient software applications, utilizing modern programming techniques, tools, and methodologies to solve real-world problems.

PSO 2 Demonstrate expertise in analyzing requirements and designing integrated software systems by applying principles of system architecture, databases, and networking for secure and scalable solutions.

PSO 3 Adapt to and apply emerging technologies such as artificial intelligence, cloud computing, and data analytics to create innovative solutions in various industry sectors.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

Post Graduates of the program will

PEO 1 Engage in professional practice and promote the development of innovative systems to optimize the solutions for Computer Science and Engineering problems.

PEO 2 Achieve peer-recognition, as an individual or in a team through good analytical, research, design and implementation skills.

PEO 3 Contribute to society as broadly educated, expressive, ethical and responsible citizens with proven expertise.

ADITYA UNIVERSITY

DEPARTMENT OF COMPUTER APPLICATIONS

Master of Computer Applications (MCA)

Program Curriculum - 2024

Credit Division:

S.No.	Category of Course	Credits
1	Program Core Courses (PCC)	46
2	Program Elective Courses (PEC)	15
4	Ability Enhancement Courses (AEC)	03
5	Technical Paper Publication (TPP)	02
6	Summer Internship (SI)	02
7	Project Work (PROJ)	12
8	Mandatory Courses (MC)	0
	Total Credits	80

Program Core Courses (PCC)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
243MC001	Computational Mathematics	2	1	0	3	50	50	100	-
243MC002	Object Oriented Software Engineering	2	0	1	3	50	50	100	-
243MC003	Artificial Intelligence	2	0	1	3	50	50	100	-
243MC004	Data Warehousing and Mining	2	0	1	3	50	50	100	-
243MC005	Advanced Java Programming	2	0	2	4	50	50	100	-
243MC006	Python Programming	1	0	2	3	50	50	100	-
243MC007	Advanced Data Structures and Algorithms	2	0	1	3	50	50	100	-
243MC008	Computer Networks	3	0	0	3	50	50	100	-
243MC009	Software Project & Testing Management	2	0	1	3	50	50	100	-
243MC010	Machine Learning with Python	2	0	2	4	50	50	100	AI
243MC011	MERN Stack Technologies	1	0	2	3	50	50	100	-
243MC012	Internet of Things (IoT)	0	0	2	2	50	50	100	-
243MC013	Agile Methodologies	1	0	2	3	50	50	100	-
243MC014	Cloud Computing	3	0	0	3	50	50	100	-
243MC015	API & MicroServices	1	0	2	3	50	50	100	MERN Stack

Program Elective Courses (PEC)

Specialization: Machine Intelligence (MI)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
243MC016	Information Retrieval Systems	3	0	0	3	50	50	100	DWM
243MC017	Recommender Systems	3	0	0	3	50	50	100	ML With Python
243MC018	Neural Networks	3	0	0	3	50	50	100	AI
243MC019	Deep Learning	2	0	1	3	50	50	100	ML With Python
243MC020	Natural Language Processing	3	0	0	3	50	50	100	AI

Specialization: Data Engineering (DE)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
243MC021	Fundamentals of Data Science	2	0	1	3	50	50	100	-
243MC022	NoSQL Databases	2	0	1	3	50	50	100	-
243MC023	Big Data Analytics	3	0	0	3	50	50	100	FDS
243MC024	Data Visualization	2	0	1	3	50	50	100	FDS
243MC025	Business Intelligence & Analytics	3	0	0	3	50	50	100	-

Specialization: Network Security (NS)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
243MC026	Ethical Hacking	2	0	1	3	50	50	100	-
243MC027	Cyber Security	3	0	0	3	50	50	100	-
243MC028	Network Security & Cryptography	2	1	0	3	50	50	100	CN
243MC029	Block Chain Technologies	3	0	0	3	50	50	100	-
243MC030	Secure Coding Techniques	3	0	0	3	50	50	100	NSC

Specialization: Full Stack Development (FSD)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
243MC035	Applied Modern Technologies	3	0	0	3	50	50	100	-
243MC036	Web Design and Development	2	0	1	3	50	50	100	-
243MC037	Advanced JavaScript	2	0	1	3	50	50	100	-
243MC038	Client-side Scripting	2	0	1	3	50	50	100	-
243MC039	Server-side Scripting	2	0	1	3	50	50	100	-

Specialization: Cloud Computing (CC)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
243MC035	Applied Modern Technologies	3	0	0	3	50	50	100	-
243MC040	Cloud Essentials	2	0	1	3	50	50	100	-
243MC041	Cloud Architecture, Services and Storage	2	0	1	3	50	50	100	-
243MC042	Cloud and DevOps	2	0	1	3	50	50	100	-
243MC043	Cloud Engineering	2	0	1	3	50	50	100	CC

Specialization: Software Testing & Quality Assurance (STQA)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
243MC035	Applied Modern Technologies	3	0	0	3	50	50	100	-
243MC044	Fundamentals of Product Management	2	0	1	3	50	50	100	-
243MC045	Software Quality Assurance	2	0	1	3	50	50	100	-
243MC046	Software Architecture	2	0	1	3	50	50	100	-
243MC047	Software Verification, Validation and Testing	2	0	1	3	50	50	100	SPTM

Ability Enhancement Courses (AEC)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
243EN001	Fundamental English Proficiency	0	0	1	1	100	0	100	-
243EN002	Advanced English Proficiency	0	0	1	1	100	0	100	-
243MC031	Design Thinking	0	0	1	1	100	0	100	-

Technical Paper Publication (TPP)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
243MC032	Technical Paper Publication	0	0	2	2	100	0	100	-

Summer Internship (SI)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
243MC033	Summer Internship	0	0	2	2	100	0	100	-

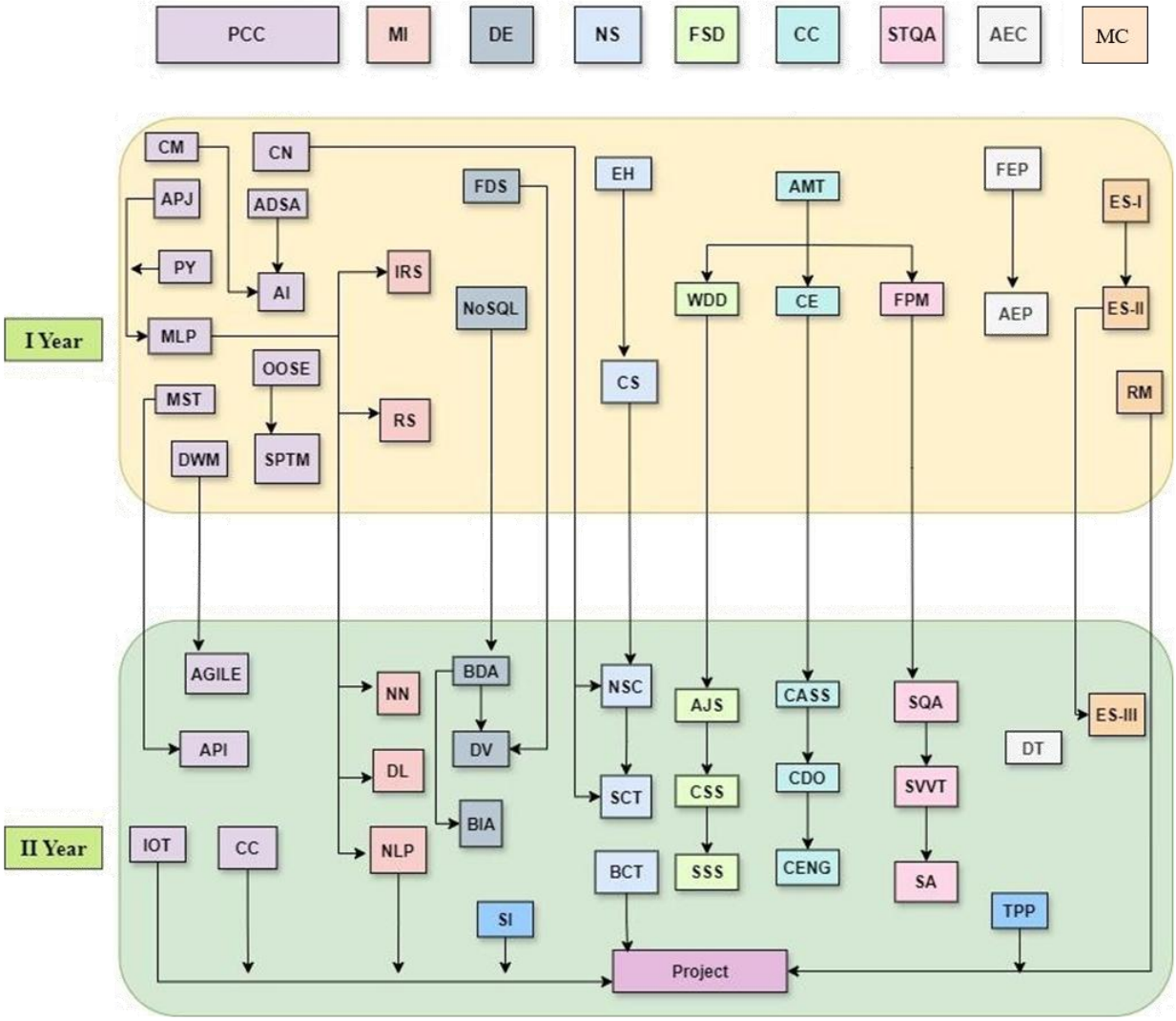
Project (PROJ)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
243MC034	Project Work	0	0	12	12	50	50	100	-

Mandatory Courses (MC)

Course Code	Course Title	L	T	P	C	CIE	SEE	Total	Pre-requisite
243AC001	Research Methodology	2	0	0	0	100	0	100	-
243AC002	Employability Skills-I	0	0	3	0	100	0	100	-
243AC003	Employability Skills-II	0	0	3	0	100	0	100	ES-I
243AC004	Employability Skills-III	0	0	3	0	100	0	100	ES-II

2024 MCA CURRICULAM
PREREQUISITE FLOW CHART



I Year Courses	
CM	Computational Mathematics
OOSE	Object Oriented Software Engineering
AI	Artificial Intelligence
DWM	Data Warehousing and Mining
AJP	Advanced Java Programming
PY	Python Programming
ADSA	Advanced Data Structures and Algorithms
CN	Computer Networks
SPTM	Software Project & Testing Management
MLP	Machine Learning with Python
MST	MERN Stack Technologies
IRS	Information Retrieval Systems
RS	Recommender Systems
FDS	Fundamentals of Data Science
NoSQL	NoSQL Databases
EH	Ethical Hacking
CS	Cyber Security
AMT	Applied Modern Technologies
WDD	Web Design and Development
CE	Cloud Essentials
FPM	Fundamentals of Product Management
FEP	Fundamental English Proficiency
AEP	Advanced English Proficiency
RM	Research Methodology
ES-I	Employability Skills-I
ES-II	Employability Skills-II

II Year Courses	
AGILE	Agile Methodologies
API	API & MicroServices
CC	Cloud Computing
IOT	Internet of Things (IoT)
NN	Neural Networks
DL	Deep Learning
NLP	Natural Language Processing
BDA	Big Data Analytics
DV	Data Visualization
BIA	Business Intelligence & Analytics
NSC	Network Security & Cryptography
SCT	Secure Coding Techniques
BCT	Block Chain Technologies
AJS	Advanced JavaScript
CSS	Client-side Scripting
SSS	Server-side Scripting
CASS	Cloud Architecture, Services and Storage
CDO	Cloud and DevOps
CENG	Cloud Engineering
SQA	Software Quality Assurance
SVVT	Software Verification, Validation and Testing
SA	Software Architecture
DT	Design Thinking
ES-III	Employability Skills-III
TPP	Technical Paper Publication
SI	Summer Internship
Project	Project Work

Suggestive Semester wise Curriculum

I Semester

Course Code	Course Title	Course Category	Credits				Total Hours
			L	T	P	Total	
243MC001	Computational Mathematics	PCC	2	1	0	3	**4**
243MC002	Object Oriented Software Engineering	PCC	2	0	1	3	**4**
243MC003	Artificial Intelligence	PCC	2	0	1	3	**4**
243MC004	Data Warehousing and Mining	PCC	2	0	1	3	**4**
243MC005	Advanced Java Programming	PCC	2	0	2	4	**6**
243MC006	Python Programming	PCC	1	0	2	3	**5**
243EN001	Fundamental English Proficiency	AEC	0	0	1	1	**2**
243AC001	Research Methodology	MC	2	0	0	0	**2**
243AC002	Employability Skills-I	MC	0	0	3	0	**3**
		Total	**13**	**1**	**11**	**20**	**34**

II Semester

Course Code	Course Title	Course Category	Credits				Total Hours
			L	T	P	Total	
243MC007	Advanced Data Structures and Algorithms	PCC	2	0	1	3	**4**
243MC008	Computer Networks	PCC	3	0	0	3	**3**
243MC009	Software Project & Testing Management	PCC	2	0	1	3	**4**
243MC010	Machine Learning with Python	PCC	2	0	2	4	**6**
243MC011	MERN Stack Technologies	PCC	1	0	2	3	**5**
---	Elective – I	PEC	0	0	0	3	**4**
243EN002	Advanced English Proficiency	AEC	0	0	1	1	**2**
243AC003	Employability Skills-II	MC	0	0	3	0	**3**
		Total	**10**	**0**	**10**	**20**	**31**

III Semester

Course Code	Course Title	Course Category	Credits				Total Hours
			L	T	P	Total	
243MC012	Internet of Things (IoT)	PCC	0	0	2	2	**4**
243MC013	Agile Methodologies	PCC	1	0	2	3	**5**
243MC014	Cloud Computing	PCC	3	0	0	3	**3**
243MC015	API & Microservices	PCC	1	0	2	3	**5**
---	Elective – II	PEC	0	0	0	3	**4**
---	Elective- III	PEC	0	0	0	3	**4**
243MC031	Design Thinking	AEC	0	0	1	1	**2**
243MC033	Summer Internship	SI	0	0	2	2	**4**
243AC004	Employability Skills-III	MC	0	0	3	0	**3**
		Total	**5**	**0**	**12**	**20**	**34**

IV Semester

Course Code	Course Title	Course Category	Credits				Total Hours
			L	T	P	Total	
---	Elective - IV	PEC	0	0	0	3	**4**
---	Elective - V	PEC	0	0	0	3	**4**
243MC032	Technical Paper Publication	TPP	0	0	2	2	**4**
243MC034	Project Work	PROJ	0	0	12	12	**24**
		Total	**0**	**0**	**14**	**20**	**36**

COMPUTATIONAL MATHEMATICS

Course Code: 243MC001	L	T	P	C
	2	1	0	3

Course Outcomes:

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

- **CO1:** Apply various probability distributions for both discrete and continuous random variables
- **CO2:** Compute mean and variance of sample means with replacement, without replacement and maximum errors
- **CO3:** Apply various tests to test the hypothesis concerning mean, Proportion and variance.
- **CO4:** Apply the concepts of group theory and number theory.
- **CO5:** Apply the knowledge of graph theory to solve real world problems like minimum spanning tree - traversal of binary tree.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

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

UNIT – I

Random Variables and Probability Distributions: Probability-Conditional probability-Baye's theorem- Random variables – Discrete and Continuous random variables – Distribution function – Mathematical Expectation, Variance and Moment generating function- Binomial, Poisson, Normal and Exponential distributions.

UNIT – II

Descriptive Statistics and Sampling Theory: Computation of mean, median, mode and variance of grouped and ungrouped data–Population and samples – Sampling with and without replacement-Sampling distribution of Means and Variance – Central limit theorem (without proof)-Point and Interval estimations – Maximum error of estimate.

UNIT – III

Tests of Hypothesis: Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples) –Tests on proportions, Z-test, t-test, F test and Chi-Square test.

UNIT – IV

Algebraic Structures and Number Theory: Algebraic Structures, Semi-Groups, Monoids, Groups, Subgroups, Abelian Group-Homomorphism, Isomorphism. Number Theory: Properties of Integers, Division Theorem, Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic, Fermat's and Euler's Theorems.

UNIT – V

Graph Theory: Basic Concepts of Graphs, Matrix Representation of Graphs: Adjacency Matrix, Incidence Matrix, Isomorphic Graphs, Paths and Circuits, Euler and Hamilton Graphs, Planar Graphs, and Euler's Formula. Tree Properties, Spanning Trees, BFS Algorithm, DFS Algorithm, Minimal Spanning Trees, and Kruskal's Algorithm, Graph coloring, chromatic number.

Text Books:

1. Probability and Statistics for Engineers- Miller and Freund's, 7/e, Pearson, ISBN-13: 9788120342132
2. Discrete Mathematics and its Applications with Combinatorics and Graph Theory - Kenneth H. Rosen, McGraw Hill Education (India) Private Limited, ISBN No. 978-0-07-068188-0

Reference Books:

1. Fundamentals of Mathematical Statistics - S. C. Gupta and V.K. Kapoor, 11/e, Sultan Chand & Sons Publications, ISBN: 978-8170147916
2. Discrete Mathematics for Computer Scientists and Mathematicians - J. L. Mott, A. Kandel T.P, 2nd Edition, Publisher: Prentice HallISBN: 978-0132122719
3. Mathematical Foundations of Computer Science - S. Santha, E. V. Prasad, Cengage Publishers.

Web Links:

1. http://mathworld.wolfram.com/topics/ProbabilityandStatistics.html
2. http://nptel.ac.in/courses/111105041/1
3. http://mathworld.wolfram.com/classroom/classes/DiscreteMathematics.html
4. https://ggc-discrete-math.github.io/
5. http://nptel.ac.in/courses/106106094/

OBJECT ORIENTED SOFTWARE ENGINEERING

Course Code: 243MC002	L	T	P	C
	2	0	1	3

Course Outcomes:

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

CO1: Understand classes, objects, inheritance, aggregation, polymorphism.
CO2: Create and analyze use cases.
CO3: Construct class diagrams with associations and multiplicity
CO4: Implement classes based on interaction and state diagrams.
CO5: Implement Model Driven Development.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	-	2	2
CO3	-	2	2
CO4	2	2	2
CO5	-	-	-

UNIT – I

Introduction to Object Orientation Software Engineering: The nature of software-Types of software- Characteristic of software-Stakeholders in software engineering – SDLC Process Models- Waterfall, RAD, Agile Software Development, Classes and objects, inheritance, types of inheritance Aggregation, Instance variables, Methods, operations and polymorphism, Organizing classes into inheritance hierarchies.

Practice:

1. Identify a software system that needs to be developed.

UNIT – II

Developing Requirements Domain Analysis: Functional Requirement and Non-Functional requirements, Requirements gathering , object-based requirements analysis , Use cases: describing how the user will use the system, techniques for gathering requirements, Managing changing requirements, class-based requirements design.

Practice:

1. Document the Software Requirements Specification (SRS) for the identified system.
2. Identify use cases and develop the Use Case model.

UNIT – III

Introduction to Uml : Essentials of UML class diagrams – Use case diagram, Activity diagram, Class diagram with Associations and multiplicity, Generalization and More advanced features of class diagrams.

Practice:

1. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram.
2. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams

UNIT – IV

User-Centered Design: Characteristics of users, The basics of user interface design, Usability principles, Evaluating user interfaces, Modeling interactions and behavior - Interaction diagrams , State diagrams , Activity diagrams , Implementing classes based on interaction and state diagrams , Difficulties and risks in modeling interactions and behavior.

Practice:

1. Identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams.
2. Draw relevant State Chart and Activity Diagrams for the same system.

UNIT – V

Architecting and Designing Software : The process of design - Principles leading to good design - Design Principles- Techniques for making good design decisions - Model Driven Development, Incorporating reusability and reuse into software engineering, Frameworks: reusable subsystems, the client-server architecture ,Technology needed to build client-server systems -The Object Client-Server Framework (OCSF).

Practice:

1. Implement Model Driven Development for software project.
2. Identify the technology needed to build client-server systems and implement the Object Client-Server Framework.

Textbooks:

1. Object-Oriented Software Engineering Practical Software Development using UML and Java, Timothy C Lethbridge, 3rd Edition, McGraw-Hill Higher Education, ISBN-13: 978-0077109080.
2. Object-Oriented Software Engineering: A Use Case Driven Approach, Ivar Jacobson, 1st Edition, Addison Wesley Longman Publishing, ISBN-13: 978-0201544350.

Reference Books:

1. "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development" by Craig Larman, 3rd Edition, Prentice Hall, ISBN-13: 978-0131489066.
2. "Design Patterns: Elements of Reusable Object-Oriented Software" by Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides (The Gang of Four), 1st Edition, Addison-Wesley Professional, ISBN-13: 978-0201633610.
3. "Object-Oriented Software Engineering Using UML, Patterns, and Java" by Bernd Bruegge and Allen H. Dutoit, 3rd Edition, Pearson, ISBN-13: 978-0136061250.

WebLinks:

1. https://www.javatpoint.com/software-engineering-object-oriented-design.
2. https://www.institutedata.com/blog/object-oriented-programming.
3. https://www.scaler.com/topics/software-engineering/object-oriented-design/

ARTIFICIAL INTELLIGENCE

Course Code: 243MC003	L	T	P	C
	2	0	1	3

Course Outcomes:

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

CO1: Use different search methods like BFS, DFS, and heuristic search to solve problems like the water jug problem and Traveling Salesman Problem.

CO2: Represent knowledge and use logical reasoning with propositional and first-order predicate logic.

CO3: Build and use Bayesian networks and fuzzy logic systems to handle uncertain information.

CO4: Create expert systems using techniques like forward chaining and blackboard architecture.

CO5: Apply techniques for understanding and processing human language.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	3	2	2
CO2	3	3	3
CO3	-	2	2
CO4	3	-	-
CO5	-	3	3

UNIT – I

Problem Solving Techniques: State Space Search: Production systems, Problem characteristics, Production system Characteristics Uninformed Search: Breadth first search, Depth first search, comparing DFS and BFS Informed Search: Heuristic search, Hill climbing, Best First Search-A* algorithm.

Practice:

1. Implementation of DFS for water jug problem.
2. Implementation of BFS for tic-tac-toe problem.
3. Implementation of TSP using heuristic approach.

UNIT – II

Knowledge Representation: Procedural Vs Declarative Knowledge, Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation, Logic Programming Forward Vs Backward Reasoning Symbolic Logic: Propositional Logic, First Order Predicate Logic: Representing Instance and is a Relationships, Computable Functions and Predicates, Syntax & Semantics of FOPL,

Normal Forms, Unification &Resolution, Representation Using Rules, and Natural Deduction.

Practice:

1. Implement a simple theorem prover for propositional logic and FOPL.
2. Demonstrate forward reasoning using a logic programming language like Prolog.

UNIT – III

Reasoning Under Uncertainty: Introduction to Non-Monotonic Reasoning, Truth Maintenance Systems, Statistical Reasoning: Bayes Theorem, Certainty Factors & Rule-Based Systems, Bayesian Probabilistic Inference, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic & Fuzzy Systems.

Practice:

1. Construct and perform inference on a Bayesian Network.
2. Design a simple fuzzy logic system for a control problem.

UNIT – IV

Experts Systems: Overview of an Expert System, Structure of an Expert Systems, Different Types of Expert Systems- Rule Based, Model Based, Case Based and Hybrid Expert Systems, Knowledge Acquisition and Validation Techniques, Black Board Architecture, Knowledge Building System Tools, Expert System Shells.

Practice:

1. Implementation Expert System with forward chaining.
2. Implement a blackboard architecture for problem solving.

UNIT – V

Natural Language Processing: Role of Knowledge in Language Understanding, Approaches Natural Language Understanding, Steps in The Natural Language Processing.

Practice:

1. Create a simple rule-based expert system.

Text Books:

1. Artificial Intelligence by Elaine Rich, McGraw-Hill Publications,3rd edition, ISBN-10: 0070087709, ISBN-13: 978-0070087705
2. Deep Learning: A practitioner's approach, Josh Patterson and Adam Gibson, First edition, Shroff Publishers and Distributors Pvt. Ltd., ISBN-10: 1491914254, ISBN-13: 978-1491914250

Reference Books:

1. Artificial Intelligence: A Modern Approach by Stuart Russell, Peter Norwig, 3rd edition, Pearson Education Publications, ISBN-10: 0136042597, ISBN-13: 978-0136042594
2. Artificial Intelligence: Structures and Strategies for Complex Problem Solving by George F Luger, 5 th edition, Pearson Education Publications, ISBN-10: 0321545893, ISBN-13: 978-0321545893
3. Artificial Intelligence- Deepak Khemani, Tata McGraw Hill (TMH), ISBN-10: 1259029982, ISBN-13: 978-1259029981

Web Links:

1. https://nptel.ac.in/courses/106/105/106105079/
2. https://www.mindmeister.com/44054594/expert-systems/
3. https://onlinecourses.nptel.ac.in/noc17_cs30/
4. https://www.slideshare.net/girishnaik/artificial-intelligence-3638681

DATA WAREHOUSING AND MINING

Course Code: 243MC004	L	T	P	C
	2	0	1	3

Course Outcomes:

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

CO1: Understand different types of data to be mined and different preprocessing techniques
CO2: Categorize the scenario for applying different data mining techniques
CO3: Evaluate different models used for classification
CO4: Implement various clustering algorithms for exploratory data analysis.
CO5: Apply outlier detection methods and techniques to identify anomalies in data sets

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	-	3	3
CO3	-	3	3
CO4	-	-	-
CO5	-	-	-

UNIT – I

Introduction and Preprocessing Data Mining Introduction: An overview of Data Mining – Kinds of data and pattern to be mined –Technologies – Targeted Applications - Major Issues in Data Mining – Data Objects and Attribute Types – Measuring Data Similarity and Dissimilarity

Data Preprocessing: Data Cleaning –Data Integration–Data Reduction–Data Transformation – Data Discretization

Practice:

1. Implement data cleaning techniques on a given dataset
2. Apply data transformation techniques to a dataset.

UNIT – II

Mining Frequent Patterns and Advanced Pattern Mining: Basic Concepts – Frequent Itemset Mining Methods – Apriori Algorithm-Generating Association Rules from Frequent Itemsets Pattern Evaluation Methods – Pattern Mining in Multilevel, Multidimensional space – Constraint-Based Frequent Pattern Mining – Mining Compressed or Approximate Patterns – Pattern Exploration and Application

Practice:

1. Implementing the Apriori Algorithm
2. Generate association rules from frequent itemsets.

UNIT – III

Classification Techniques: Classification – Model Evaluation and Selection – Techniques to Improve Classification Accuracy – Classification by Backpropagation – Support Vector Machines – Learning from Neighbors.

Practice:

1. Implement a decision tree classifier on a sample dataset.
2. Implement SVM for classification.

UNIT – IV

Clustering Techniques: Cluster Analysis – Definition – Types of Data in Cluster Analysis, Clustering methods– Partitioning Methods – k-Means– k-Medoids– Hierarchical Methods –Agglomerative versus Divisive Hierarchical Clustering –BIRCH–Density-Based Methods–DBSCAN

Practice:

1. Implement k-Means clustering on a dataset.

UNIT – V

Outlier Detection and Applications: Outliers and Outlier Analysis – Clustering-Based Approach – Classification-Based Approach – Mining Complex Data Types – Data Mining Applications.

Practice:

1. Identify outliers using a clustering approach (e.g., DBSCAN).
2. Implement outlier detection using the Z-score method.

Text Books:

1. Data Mining Concept and Techniques, Jiawei Han, Micheline Kamber, Jian Pie, Third Edition ,Morgan and Kaufmann Publisher, , ISBN-13: 9780123814807.
2. Data Mining Techniques, Arun K Pujari, Second Edition, Universities Press India Pvt. Ltd.ISBN-10:8173718123

Reference Books:

1. Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, 2nd Edition, ISBN: 978-0138143810
2. Data Mining: Practical Machine Learning Tools and Techniques, Ian H. Witten, Eibe Frank, Mark A. Hall, Third Edition.,Morgan and Kaufmann Publisher, ISBN-10:0124046512

Web Links:

1. https://data-flair.training/blogs/data-mining-tutorial/
2. https://www.geeksforgeeks.org/difference-between-data-warehousing-and-data-mining
3. https://www.javatpoint.com/data-mining-cluster-vs-data-warehousing

ADVANCED JAVA PROGRAMMING

Course Code: 243MC005	L	T	P	C
	2	0	2	4

Course Outcomes:

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

- **CO1:** Utilize fundamental OOP concepts and Java basics, including data types, control statements, and class structures.
- **CO2:** Explore inheritance, interfaces, and package management in Java.
- **CO3:** Implement effective exception handling and multithreading techniques to create robust and efficient Java applications.
- **CO4:** Gain proficiency in JDBC to connect and perform CRUD operations on databases
- **CO5:** Develop dynamic web applications using Java Servlets and JSP by understanding their life cycles and core components.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	2	-	-
CO3	-	1	1
CO4	2	-	-
CO5	2	2	2

UNIT – I

Introduction to Oops and Classes: OOPs concepts, Programming Paradigm, Basics of Java,Data Types, Variables, Operators, Control Statements, Loops and Arrays.

Classes and Objects: Class Fundamentals - Declaring Objects - Introducing Methods - Overloading methods – Constructors - Parameterized Constructors - this Keyword.Class Features:Garbage Collection - the finalize () Method - Introducing Access Control - Understanding static - Introducing nested and inner classes - String class - String Buffer Class - Command Line Arguments.

Practice:

1. Write a Java Program to generate Fibonacci sequence for n numbers
2. Write a Java Program that prompts the user for an integer and then prints out all the prime numbers up to that Integer
3. Write a Java Program to demonstrate String and StringBuffer class methods.
4. Implement the concept of constructor overloading

UNIT – II

Inheritance: Inheritance Basics - Multilevel Hierarchy- Using super - Method overriding - Dynamic Method Dispatch- Abstract keyword- Using final with inheritance - The Object Class.

Interfaces and Packages: Inheritance in java with Interfaces – Defining Interfaces - Implementing Interfaces - Extending Interfaces- Creating Packages - CLASSPATH variable - Access protection - Importing Packages - Interfaces in a Package.

Practice:

1. Implement the concept of inheritance, super, abstract and final keywords.
2. Write a java program for dynamic dispatch of methods.
3. Write a Java Program to create and demonstrate packages
4. Implement the concept of package and interface.

UNIT – III

Exception Handling: Exception Handling Fundamentals, Exception Types, Uncaught Exceptions, Using Try and Catch, Multiple Catch clauses, Nested try Statements, Java's Built-in Exceptions, Creating your own Exception subclasses,

Multithreading Java: Thread Model - Life cycle of a Thread - Java Thread Priorities - Runnable interface and Thread Class- Thread Synchronization – Inter Thread Communication.

Practice:

1. Write a Java program to illustrate exception handling mechanism using multiple catch clauses.
2. Implement the concept of multi threading.

UNIT – IV

JDBC: Introduction to JDBC- Connecting to the database- Basic JDBC Operations – Essential JDBC Classes – JDBC Drivers – JDBC-ODBC Bridge – Connecting to a database with driver manager – JDBC database URL, CRUD Operations.

Practice:

1. Write a JDBC program to perform CRUD operations

UNIT – V

Java Servlets: Servlets Basics – Life Cycle of a Servlet –A Simple Servlet - The Servlet API – Servlet Interfaces – Generic Servlet Class- HttpServletRequest Interface – HttpServeltResponse

JSP: The JSP development model – component of jsp page – Page directive – Action – scriptlet – JSP expression, JSP Syntax and semantics, JSP in XML.

Practice:

1. Write a program to receive two numbers from a HTML form and display their sum in HTTPServlet.
2. Write a program to Authenticate using JSP
3. Write a JSP program calculates factorial values for an integer number, while the input is taken from an HTML form.

Additional Practice:

1. Write a Java Program, using String Tokenizer class, which reads a line of integers and then displays each integer and the sum of all integers.
2. Write a program to Authenticate using Java Servlet
3. Write a program Program to store the user information into cookies, and to display the above stored information by retrieving from cookies.
4. Write a Java program to solve Producer-Consumer problem using synchronization

Text Books:

1. The Complete Reference Java, Schildt Herbert, 9th Edition, Tata McGraw-Hill, 2019, ISBN-101259003462
2. The Complete Reference JSP 2.0, Phil Anna, 2nd Edition, Tata McGraw-Hill, ISBN-10: 0070580010

Reference Books:

1. Introduction to java programming, by Y Daniel Liang, 7th Edition, Pearson, ISBN-10:1259003462
2. Core Java Volume I Fundamentals, Cay S. Horstmann,11th Edition,Pearson, ISBN-10**:** 0137081896
3. "Programming with Java," E Balagurusamy, 6th Edition, McGraw-Hill, ISBN-10:1260571342

Web Links:

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://docs.oracle.com/javase/tutorial/
3. https://www.programiz.com/java-programming
4. https://cse.iitkgp.ac.in/~dsamanta/java/index.htm
5. https://onlinecourses.swayam2.ac.in/aic20_sp13/preview

PYTHON PROGRAMMING

Course Code: 243MC006	L	T	P	C
	1	0	2	3

Course Outcomes:

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

- **CO1:** Demonstrate the use of IDEs like I python and Spyder.
- **CO2:** Apply Python operators and expressions to develop conditional and iterative logic structures
- **CO3:** Effectively utilize Python's data structures to perform operations and manage data efficiently
- **CO4:** Analyze and manipulate strings in Python using built-in methods.
- **CO5:** Develop Python programs using user-defined functions and nltk for advanced data processing and analysis.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	3	1	-
CO2	2	2	2
CO3	3	-	1
CO4	2	-	3
CO5	3	3	3

UNIT – I

Introduction to Python: History of Python, Unique features of Python, Demo on IDE, Ipython, Spyder etc., "Hello world" program in Python, Keywords, Identifiers, Reading input from user-Demo, Python Data Types, Declaring and using Numeric data types: int, float, complex and string

Practice:

1. Write a Python program to display "Hello, World!" and explore basic operations such as printing the value of variables and reading input from the user.
2. Create a Python script that prompts the user to input their age and then displays their age, demonstrating the use of different data types (int, float, complex, and str).

UNIT – II

Python Operators, Expressions and Flow Controls : All Operations and simple expressions, Conditional blocks using if, else and elif, Simple for loops in python, for loop using ranges, Use of while and do while-loop in python, Loop manipulation using pass, continue, break and else.

Practice:

1. Write a Python program that takes input from the user and determines if the number is positive, negative, or zero using conditional statements (if, else, elif).
2. Develop a Python script that calculates the factorial of a number using both for and while loops, demonstrating the use of loop control statements (pass, continue, break, and else).

UNIT – III

Pythons List, Tuples, Dictionaries & Sets : Lists and its operations, Ranges: Iterators and its purpose, Tuples: Operation and usage, Python Dictionaries, examples on Dictionaries, Sets and its operations

Practice:

1. Create a Python program that performs various operations on lists (such as adding, removing, sorting, and reversing) and tuples (accessing elements, slicing, and unpacking).
2. Develop a Python script that creates a dictionary to store and retrieve contact details (name and phone number) and demonstrates adding, updating, and deleting entries.

UNIT – IV

Python Strings & Regular Expressions: Strings: Understanding string in build methods and Operations[slicing],

Regular Expressions: Powerful pattern matching and searching, Power of pattern searching using regex in python, Real time parsing of networking or system data using regex, Password, email, url validation using regular expression, Pattern finding programs using regular expression

Practice:

1. Write a Python program to demonstrate different string operations such as concatenation, slicing, and finding the length of a string.
2. Create a Python script that uses regular expressions to validate user input for an email address and a password, ensuring they meet specific criteria (e.g., email format and password strength).

UNIT – V

Python Functions, Exceptions and Packages: Python user defined functions, Python packages functions, Defining and calling Function, powerful Lamda function in python, organizing python codes using functions, Programming using Exception handling, pandas, NumPy, Scikit, nltk etc.

Practice:

1. Develop a Python function that takes a list of numbers as input and returns the sum of the squares of the numbers. Include error handling to manage incorrect inputs.
2. Create a Python script that uses Pandas to read a CSV file and perform basic data analysis, such as finding the mean, median, and mode of a dataset.

Additional Practice:

1. Design a Python project that integrates lists, dictionaries, and file handling to create a simple contact management system that can add, view, update, and delete contacts, with data stored in a file.
2. Write a Python program that uses functions, loops, and regular expressions to search through a text file for lines matching a specific pattern, such as IP addresses or URLs, and output the results.

3. Develop a Python script that uses NumPy to perform matrix operations (addition, subtraction, multiplication) and integrates this with functions and exception handling.

Text Books:

1. Core Python Programming, Wesley J. Chun, Second Edition, Pearson. ISBN-13, 978-0132269933.
2. Think Python How to Think Like a Computer Scientist, Allen B. Downey 2nd Edition, Version 2.4.0. ISBN-13 978-1491939369.

Reference Books:

1. An Introduction to Python Tutorial Guido van Rossum and the Python development team, version 3.2.1,Python Software Foundation . ISBN-13: 978-9355425218
2. A Practical Introduction to Python Programming, Brian Heinold, Generic Publication ISBN-13: 9798848271577.
3. Python For Everybody: Python Programming Made Easy Kindle Edition, ISBN 13: 9781329427426.

Web Links:

1. https://www.w3schools.com/python/default.asp
2. https://www.geeksforgeeks.org/python-programming
3. http://www.cse.iitm.ac.in/~rupesh/books/python

ADVANCED DATA STRUCTURES AND ALGORITHMS

Course Code: 243MC007	L	T	P	C
	2	0	1	3

Course Outcomes:

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

- **CO1:** Implement fundamental data structures such as stacks, queues, and matrices
- **CO2:** Apply linked list implementations of stacks and queues to solve problems
- **CO3:** Analyze the asymptotic performance of the algorithm
- **CO4:** Categorize various tree algorithms for efficient data retrieval and manipulation
- **CO5:** Apply greedy and dynamic programming approaches to solve optimization problems

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	-	2	2
CO3	-	3	3
CO4	-	-	-
CO5	-	3	3

UNIT – I

Introduction to Data Structures And Data Types: Overview of Arrays**,** Classification of Data Structures, Storage structure of linear array,Implementation of Stacks, Queues and circular queues using arrays, storage representation of matrices and sparsematrices, deques and priority queues

Practice:

1. Implement and analyze the operations of stacks, queues, and circular queues using arrays.
2. Implement and analyze the operations of circular queues using arrays.
3. Implement storage representations of matrices and sparse matrices.

UNIT – II

Stacks, Queues and Circular Queues: Implementation using singly linked, doubly linked list. Applications of stacks – Evaluation of postfix expression, infix to postfix, recursion

Practice:

1. Implement and analyze the operations of stacks using singly and doubly linked lists.
2. Implement and analyze the operations of queues using singly and doubly linked lists.
3. Write a program to evaluate postfix expression

UNIT – III

Notion of Algorithm: Asymptotic Notations, Mathematical Analysis of Non Recursive algorithms: Linear Search, Selection Sort, Bubble Sort, Insertion Sort

Mathematical Analysis of Recursive Algorithms: Factorial of a number, Tower of Hanoi, nth Fibonacci number Divide and Conquer Algorithms: Binary Search, Merge sort, Quicksort.

Practice:

1. Analyze the time complexity of sorting algorithms
2. Analyze the time complexity of recursive algorithms

UNIT – IV

INTRODUCTION TO TREES: Representation of Binary trees using array and list, Binary tree traversals, Binary search trees, Transform & Conquer: AVL tress, 2-3 trees, Heaps and Heap sort

Practice:

1. Implement and analyze operations on Binary Search Trees
2. Implement a Heap data structure and Heap sort algorithm.

UNIT – V

Graph Representations, Decrease & Conquer Algorithms: Graph Traversal Algorithms, Topological Ordering

Greedy Algorithms: To Find Minimum Spanning Tree, Single Source Shortest Path algorithm

Dynamic Programming: Binomial Coefficient, transitive closure and All pair shortest path algorithms

Practice:

1. Implement DFS graph traversal algorithm
2. Implement Kruskal's algorithms for finding Minimum Spanning Treee

Text Books:

1. "Data Structures", Lipschutz Seymour ,Revised First Edition, Schaum's Outline Series, McGraw Hill Education India, ISBN-10**:** 0070605188
2. "Introduction to the Design and Analysis of Algorithms", Anany Levitin, Third Edition, Pearson Education**.** ISBN-10: 0132316817

Reference Books:

1. Data structures-A pseudocode approach with C, Richard F. Gilberg and Behrouz A. Fourouzan, 2nd Edition, 2005,Cengage Learning, ISBN-10**:** 0619216490
2. An Introduction to Data Structures With Application, Jean-Paul Tremblay, Paul G. Sorenson, 2nd Edition, Mcgraw Hill , ISBN-10: 0072943790
3. "Introduction to Algorithms", Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Third Edition, PHI Learning**,** ISBN-10**:** 0262033844

Web Links:

1. http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures
2. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
3. https://onlinecourses.nptel.ac.in/noc16_cs06/preview
4. http://nptel.ac.in/courses/106101060
5. https://nptel.ac.in/courses/106/106/106106145

COMPUTER NETWORKS

Course Code: 243MC008	L	T	P	C
	3	0	0	3

Course Outcomes:

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

- **CO1:** Understand protocol layers, network components, and their roles in Internet communication.
- **CO2:** Apply principles of network applications like HTTP, FTP, email, and DNS in practical scenarios.
- **CO3:** Demonstrate understanding of TCP and UDP functionalities in reliable data transfer.
- **CO4:** Analyze IP addressing, routing algorithms (Link State, Distance-Vector), and their impact on network performance.
- **CO5:** Implement error detection, multiple access protocols, and understand their role in network connectivity.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	3	1	1
CO2	1	3	3
CO3	2	1	1
CO4	2	2	2
CO5	3	-	-

UNIT – I

Introduction to Computer Networks, Protocol Layers: Computer Networks and the Internet, What is Internet? The network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and their Service Models.

UNIT – II

Application Layer: Application Layer: Principles of Network Applications, The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, DNS-The Internet's Directory Service: Services provided by DNS, overview of how DNS works.

UNIT – III

Data Link Layer: Error Detection and Correction – Block Coding, Cyclic Redundancy Check, Checksum, Data Link Control – Framing, Flow and Error Control, Multiple Access – Random Access, ALOHA, CSMA, CSMA/CD, CSMA/CA, Channelization.

UNIT – IV

The Network Layer: Overview of Network Layer, What's inside a Router? The Internet Protocol (IP), Routing Algorithms: Link State Routing Algorithm, Distance-Vector Routing Algorithm

UNIT – V

The Link Layer: Introduction to the link layer, Error-Detection and Correction Techniques, Multiple Access Links and Protocols: Channel Partition, Random Access protocols, Taking-turns protocol

Text Books:

1. "Computer Networking":A Top-Down Approach, James F Kurose and Keith W Ross, 8th Edition, Pearson Publication, ISBN-10: 1292405465, ISBN-13: 978-1292405469
2. Data communications and networking: Behrouz Forouzan, Edition 5, McGraw Hill, ISBN- 10: 0073376221, ISBN-13: 978-0073376226

Reference Books:

1. "Computer Networks", Andrew S. Tanenbaum and David J. Wetherill, 5th edition, Prentice Hall, ISBN-10: 0132126958, ISBN-13: 978-0132126953
2. "Computer Networks": A Systems Approach, Larry L Peterson and Bruce S. Davie, 6th Edition, Morgan Kaufmann, ISBN-10: 0128182006, ISBN-13: 978-0128182000

Web Links:

1. https://nptel.ac.in/courses/106105081
2. https://gaia.cs.umass.edu/kurose_ross/lectures.php
3. https://archive.nptel.ac.in/courses/106/105/106105183/
4. https://www.coursera.org/learn/fundamentals-network-communications

SOFTWARE PROJECT AND TESTING MANAGEMENT

Course Code: 243MC009

L	T	P	C
2	0	1	3

Course Outcomes:

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

CO1: Understand software process models and estimation techniques.
CO2: Identify, assess, and plan for project risks.
CO3: Design test cases from requirements and design.
CO4: Apply black box testing techniques for software validation.
CO5: Conduct static and regression testing to ensure software quality.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	3	2	2
CO2	2	2	2
CO3	2	2	2
CO4	2	1	1
CO5	2	1	1

UNIT – I

Introduction to Project Planning: Introduction to Project Management, Importance of Software Project Management. Categorization of Software Projects, Setting objectives.

Project Life Cycle and Effort Estimation: Software Process Models, Rapid Application development, Agile methods, Extreme Programming, Reliability Growth Models, Load Testing Model,Managing, Basics of Software estimation, Effort and Cost estimation techniques, COSMIC Full function points, COCOMO

Practice:

1. Using COCOMO model estimate effort.
2. Perform Estimation of effort using FP Estimation for chosen system.

UNIT – II

Activity Planning And Risk Management: Objectives of Activity planning, Project schedules, Activities, Sequencing and scheduling, Network Planning models, Formulating Network Model, Forward Pass & Backward Pass techniques, Critical path (CRM) method, Risk identification, Assessment, Risk Planning, Risk Management, PERT technique, Project Management and Control.

Practice:

1. Analyze the Risk related to the project and prepare RMMM plan.
2. Develop Time-line chart and project table using PERT or CPM project scheduling methods.

UNIT – III

Project Management Tools: JIRA, Asana, Trello, Basecamp, Smartsheet.

Software Testing: Introduction, Software testing principles, The tester's role in a software development organization.

Verification and Validation: Verification & Validation Activities, Verification, Verification of Requirements, verifying code, Validation.

Practice:

1. Design of Test cases based on requirements and design.
2. Prepare FTR.

UNIT – IV

Black Box Testing Techniques: Requirement based testing, Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table-based testing, Cause-Effect Graphing based testing, Error guessing

White-Box Testing: need, Logic Coverage criteria, Basis Path testing, Graph matrices, Loop testing, data flow testing, mutation testing.

Practice:

1. Design test cases based on the decision table.
2. Design test cases to cover different data flow scenarios.

UNIT – V

Levels of Testing: Need for Levels of Testing, unit testing, Integration testing, system testing, Regression testing, Acceptance testing.

Static and Regression Testing: Inspections, Structured Walkthroughs, Technical Reviews, Progressives Vs regressive testing, Regression test ability, Objectives of regression testing, Regression testing types, Regression testing techniques.

Practice:

1. Conduct a walkthrough meeting with stakeholders and Gather feedback and identify issues.
2. Design and execute regression test cases.

Text Books:

1. "Software Project Management" – Bob Hughes, Mike Cotterell and Rajib Mall: Fifth Edition, McGraw Hill,New Delhi, ISBN - 9780077122799.
2. "Software Quality Assurance, Testing and Metrics" by Anirban Basu, 1st Edition, PHI Learning, ISBN: 978-8120339988.

Reference Books:

1. "Software Testing: A Craftsman's Approach" by Paul C. Jorgensen, 4th Edition, CRC Press, ISBN - 978-1466560680.
2. Foundations of Software testing, Aditya P Mathur, 2nd ed, Pearson. ISBN - 978-0137035150
3. "Managing Global Software Projects" by Gopalaswamy Ramesh, Fourteenth Reprint edition published by McGraw Hill Education, ISBN - 978-0070613224.
4. Software Testing, Principles and Practices, Naresh Chauhan, 2nd Edition**,** Oxford, ISBN-9780199465873.

Web Links:

1. https://www.coursera.org/specializations/product-management
2. https://onlinecourses.nptel.ac.in/noc18_mg08/preview.
3. https://www.scribd.com/doc/7102316/Software-Project-Management
4. https://www.tutorialspoint.com/software_testing_dictionary/test_tools.htm
5. https://onlinecourses.nptel.ac.in/noc23_cs38/preview
6. https://www.javatpoint.com/software-testing-tutorial7
7. https://www.javatpoint.com/software-testing-tutorial7

MACHINE LEARNING WITH PYTHON

Course Code: 243MC010	L	T	P	C
	2	0	2	4

Course Outcomes:

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

- **CO1:** Understand the basics of machine learning, including data representation, classification challenges, and validation techniques.
- **CO2:** Apply linear regression and regularization techniques to build more accurate predictive models.
- **CO3:** Implement clustering algorithms like K-Means and hierarchical clustering to group data effectively.
- **CO4:** Use decision trees, Bayesian classification, and k-Nearest Neighbor (k-NN) for pattern recognition and prediction tasks.
- **CO5:** Apply advanced techniques such as regression analysis, logistic regression, and reinforcement learning to solve complex problems.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	3	1	1
CO2	1	3	3
CO3	-	3	3
CO4	3	3	3
CO5	3	1	1

UNIT – I

Introduction to Machine Learning: Problems, data and tools. Learning systems, goals, challenges and applications of the machine learning systems. Aspects of developing system, training data, testing data, concept representation, classification errors, validation. Dimensionality Reduction, Data compression, PCA.

Practice:

1. Implement a Python program to load a dataset (e.g., CSV file), preprocess it (e.g., handle missing values), and split it into training and testing sets.
2. Implement PCA to reduce the dimensionality of the dataset and visualize the principal components.

UNIT – II

Linear Regression and Regularization: Linear regression, SSE, gradient descent, bias and variance estimation, overfitting and underfitting, regularization, ridge and lasso regression.

Practice:

1. Develop a Python program to implement simple linear regression using gradient descent.
2. Develop a Python program to implement simple linear regression using ridge or lasso regression.

UNIT – III

Clustering Techniques: Clustering – Introduction – Mixture Densities, K-Means Clustering – Mixtures of Latent Variable Models – Supervised Learning after Clustering – Spectral Clustering – Hierarchical Clustering – Clustering – Choosing the number of Clusters.

Practice:

1. Implement K-Means clustering in Python to group a dataset into clusters based on similarity.
2. Write a Python program to perform hierarchical clustering on a dataset.

UNIT – IV

Classification Methods: Basic Concepts: Basic Concepts, Decision Tree Induction: Attribute Selection Measures Tree Pruning, Bayes Classification Methods, Rule- Based Classification, k-Nearest Neighbour method. Model Evaluation and Selection.

Practice:

1. Develop a Python program to build a decision tree classifier using a dataset.
2. Implement the k-Nearest Neighbor algorithm in Python for classification tasks.

UNIT – V

Advanced Machine Learning: Regression Analysis: Linear Regression, Logistic Regression, Support Vector Regression. Reinforcement Learning: Introduction, Single state case, elements of reinforcement learning, Temporal difference learning, Generalization, partially observed state.

Practice:

1. Implement logistic regression in Python to model binary classification problems.
2. Develop a Python program to implement a simple reinforcement learning algorithm.

Additional Practice:

1. Implement Density-Based Spatial Clustering of Applications with Noise (DBSCAN).
2. Implement k-fold cross-validation to evaluate the performance of a machine learning model.
3. Implement a random forest classifier and compare it with a decision tree.
4. Implement SVM for a classification task with a non-linear decision boundary.

Text Books:

1. Machine Learning, Tom Mitchell, McGraw Hill, ISBN-10: 0070428077, ISBN-13: 978-0070428072
2. “Pattern Classification” - Duda, Richard, Peter Hart, and David Stork, Second Edition, New York, NY: Wiley-Interscience, ISBN-10: 0471056693, ISBN-13 978-0471056690

Reference Books:

1. Data Mining Concepts and Techniques - Jiawei Han, Micheline Kamber, Jian Pie, Third Edition, Morgan and Kaufmann Publisher, ISBN-10: 9780123814791, ISBN-13: 978-9380931913
2. The Elements of Statistical Learning: Data Mining, Inference and Prediction- T. Hastie, R. Tibshirani and J. Friedman, 2nd Edition, Springer ppublication, ISBN-10: 0387848576, ISBN-13: 978-0387848570

Web Links:

1. https://data-flair.training/blogs/data-mining-tutorial/
2. https://machinelearningmastery.com/
3. https://towardsdatascience.com/
4. https://scikit-learn.org/stable/
5. https://nptel.ac.in/courses/106106139

MERN STACK TECHNOLOGIES

Course Code: 243MC011	L	T	P	C
	1	0	2	3

Course Outcomes:

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

CO1: Make use of HTML elements and their attributes for designing static web pages.

CO2: Build a web page by applying appropriate CSS styles to HTML elements.

CO3: Experiment with JavaScript to develop dynamic web pages and validate forms.

CO4: Build a basic web server using Node.js and also working with Node Package Manager

CO5: Make use of Typescript to optimize JavaScript code using strict type checking

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	1	-	-
CO3	2	1	1
CO4	2	-	-
CO5	2	2	2

UNIT – I

Introduction to Html: Introduction to HTML tags, HTML Attributes, Lists, Links and Images, HTML Tables Tags, Forms and Frames.

Practice:

1. Write a HTML program, to explain the working of lists.
   Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.
2. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.
   Note: Use text to link https://www.aec.edu.in/
   Use image to link https://www.aec.edu.in/?p=Gallery
3. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.
4. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique.

5. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)
6. Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).
7. Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select> & <option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).
8. Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame image, second frame paragraph, third frame hyperlink. And also make sure of using "no frame" attribute such that frames to be fixed).

UNIT – II

Introduction to Css: HTML 5 and Cascading Style Sheets, Types of CSS, Selector forms, CSS with Color, Background, Font, Text and CSS Box Model

Practice:

1. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, , tags.
2. Write a HTML program, to embed audio and video into HTML web page.
3. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).
4. Write a program to apply different types of selector forms
   i. Simple selector (element, id, class, group, universal)
   ii. Combinator selector (descendant, child, adjacent sibling, general sibling)
   iii. Pseudo-class selector
   iv. Pseudo-element selector
   v. Attribute selector
5. Write a program to demonstrate the various ways you can reference a color in CSS.
6. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.
7. Write a program using the following terms related to CSS font and text:
   i. font-size ii. font-weight iii. font-style
   iv. text-decoration v. text-transformation vi. text-alignment
8. Write a program, to explain the importance of CSS Box model using
   i. Content ii. Border iii. Margin iv. padding

UNIT – III

JAVA Script; History of javaScript,Applying JavaScript - internal and external, I/O, Type Conversion,Datatypes,Arrays ,variables, Javascript Pre-defined and User-defined Objects, Javascript Conditional Statements and Loops, Javascript Functions and Events

Practice:

1. Write a program to embed internal and external JavaScript in a web page.
2. Write a program to explain the different ways for displaying output.
3. Write a program to explain the different ways for taking input.
4. Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not.

5. Write a program using document object properties and methods.
6. Write a program using window object properties and methods.
7. Write a program using array object properties and methods.
8. Write a program using math object properties and methods.
9. Write a program using string object properties and methods.
10. Write a program using regex object properties and methods.
11. Write a program using date object properties and methods.
12. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.
13. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".
14. Write a program to display week days using switch case.
15. Write a program to print 1 to 10 numbers using for, while and do-while loops.
16. Write a program to print data in object using for-in, for-each and for-of loops
17. Design a appropriate function should be called to display
    i. Factorial of that number
    ii. Fibonacci series up to that number
18. Design a HTML having a text box and four buttons named Factorial, Fibonacci, When a button is pressed an appropriate function should be called to display
    i. Factorial of that number
    ii. Fibonacci series up to that number
19. Write a program to validate the following fields in a registration page
    i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
    ii. Mobile (only numbers and length 10 digits)
    iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

UNIT – IV

NODE.JS: installation of Node.js,data transfer over Http protocol, Why and What Node.js, How to use Node.js, Create a web server in Node.js, Node Package Manager, Modular programming in Node.js, Restarting Node Application, File Operations.

Practice:

1. Write a program to show the workflow of JavaScript code executable by creating web server in Node.js.
2. Write a program to transfer data over http protocol using http module.
3. Create a text file src.txt and add the following content to it. (HTML, CSS, Javascript, Typescript, MongoDB, Express.js, React.js, Node.js)
4. Write a program to parse an URL using URL module.
5. Write a program to create an user-defined module and show the workflow of Modularization of application using Node.js

UNIT – V

Typescript: Simple and special Types,function parameters,importance of Arrow function,optional,default and REST parameters. Installing TypeScript, Basics of TypeScript, Function, Parameter Types and Return Types, Arrow Function, Function Types, Optional and Default Parameters, Rest Parameter, Creating an Interface, Duck Typing, Function Types, Extending Interfaces, Classes, Constructor, Access Modifiers, Properties and Methods

Practice:

1. Write a program to understand simple and special types.
2. Write a program to understand function parameter and return types.
3. Write a program to show the importance with Arrow function. Use optional, default and REST parameters.
4. Write a program to understand the working of typescript with class, constructor, properties, methods and access specifiers.

Additional Practice:

1. Write a CSS program,to apply 2D and 3D transformations in a web page
2. Design a web page with page with new features of HTML file and CSS3.
3. Design a to-do list application using javascript

Text Books:

1. "Programming the World Wide Web", Robet W Sebesta ,7th Edition, Pearson Education,ISBN:978-0132665810.
2. "Ultimate Full-Stack Web Development with MERN" ,Nabendu Biswas, 1st Edition orange Education, ISBN: 978-8119416424.
3. ""Node.js Web Development: Server-Side Web Development Made Easy with Node 14", David Heron,4th Edition, Packt Publishing, ISBN: 978-1801071046.

Reference Books:

1. "Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node", Vasan Subramanian,"O'Reilly, 2nd edition, APress, ISBN:978-84243909.
2. "MERN Stack Front To Back: Full Stack React", Redux and Node.js by Brad raversy, 1st Edition, ISBN: 978-1789343120.

Web Links:

1. https://www.w3schools.com/html
2. https://www.w3schools.com/css
3. https://www.w3schools.com/js/
4. https://www.w3schools.com/nodejs

INTERNET OF THINGS (IoT)

Course Code: 243MC012	L	T	P	C
	0	0	2	2

Course Outcomes:

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

CO1: Choose the sensors and actuators for an IoT application.
CO2: Select protocols for a specific IoT application.
CO3: Utilize the cloud platform and APIs for IoT application.
CO4: Experiment with embedded boards for creating IoT prototypes.
CO5: Design a solution for a given IoT application.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1:	2	-	-
CO2:	2	-	-
CO3:	2	-	2
CO4:	1	-	2
CO5:	1	1	2

Practice:

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
6. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smart phone using Bluetooth.
8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smart phone using Bluetooth.

9. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thing speak cloud.
10. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thing speak cloud.
11. To install MySQL database on Raspberry Pi and perform basic SQL queries.
12. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.

Additional Practice:

1. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
2. Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.
3. Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.

Text Books:

1. Internet of Things: Architecture, Design Principles And Applications, 1st Edition, Rajkamal, McGraw Hill Higher Education. ISBN-13: 978-1259006221.
2. Internet of Things: A Hands-On Approach, 2nd Edition, 2020. Vijay Madisetti and Arshdeep Bahga ,VPT (Vijay Madisetti Publications) ISBN-13: 978-0996025515.

Reference Books:

1. IoT Fundamentals, Networking Technologies, Protocols and Use Cases for the Internet of Things, 2nd Edition, 2021.David Hanes, Gonzalo Salgueiro, Patrick Grossetette, Rob Barton, Jerome Henry, CISCO, Pearson. ISBN-13: 978-1587144110
2. Designing the Internet of Things, 1st Edition, Adrian McEwen and Hakim Cassimally,Wiley. ISBN-13: 978-1118430625.
3. An Introduction to Internet of Things, Connecting devices, Edge Gateway and Cloud with Applications, 1st Edition, 2019. Rahul Dubey, Cengage, Adrian McEwen,Wiley Publishers. ISBN-13: 978-0359844174.

Web Links:

1. https://iotify.io/iot-virtual-lab/
2. https://www.coursera.org/specializations/iot
3. https://www.tinkercad.com/

AGILE METHODOLOGIES

Course Code: 243MC013	L	T	P	C
	1	0	2	3

Course Outcomes:

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

CO1: Understand software lifecycle, agility, DevOps, CI/CD, Scrum, and Kanban.
CO2: Practice XP programming for automation and test-driven development.
CO3: Simulate Scrum roles and ceremonies.
CO4: Apply customer collaboration, bottleneck resolution, and Git for CI/CD.
CO5: Implement Scrum for team formation and scaling, track project metrics.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	1	1

UNIT – I

Agile Software Development Ecosystems: Agile development model, DevOps, and ITIL, DevOps process and Continuous Delivery, Release management, Scrum, Kanban, DevOps delivery pipeline, bottlenecks, DevOps eco system.

Practice:

1. Get an understanding of the stages in software development lifecycle, the process Models.
2. Get an understanding of the values and principles of agility and the need for agile software development.

UNIT – II

Fundamentals of Devops: Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system.

Practice:

1. It is important to comprehend the need to automate the software development lifecycle stages through DevOps.
2. Gain an understanding of the capabilities required to implement DevOps, continuous integration and continuous delivery practices.

UNIT – III

Backdrop-The Science of Scrum: The Skelton and Heart of Scrum, Scrum Roles, Scrum Flow, Scrum Artifacts New Management Responsibilities: The Scrum Master at Meta Eco, The Product Owner at Mega Energy, The team at Service 1st.The Scrum Master: The Untrained Scrum Masterat Trey Research, The Untrained Scrum Master at Lit Ware.

Practice:

1. Set up a Kanban board and demonstrate the workflow.
2. Create a Scrum board using tools like Jira or Trello.
3. Discuss and document the responsibilities of Scrum roles in different case scenarios.

UNIT – IV

The Product Owner and Introduction To Ci/Cd : Customer and team Collaboration, Getting Service 1St Management Back in Action, Fixing the problem of X flow at Mega fund, Company Goals at Techcore, Company Goals at Mega Bank Fund Transfer System **Planning A Scrum Project**: Managing Cash at Mega Bank, Certified Scrum Masters Take on Return on Investment. Introduction to Continuous Integration, Continuous Delivery and Deployment, Benefits of CI/CD, Metrics to track CICD practices.

Practice:

1. Configure the web application and Version control using Git using Git commands and version control operations.
2. Configure a static code analyzer which will perform static analysis of the web application code and identify the coding practices that are not appropriate.
3. Configure the profiles and dashboard of the static code analysis tool.

UNIT – V

The Team: Team Formation at Service 1ST, Giving the team a Chance at Web New Site. Scaling the Project with Scrum: Scaling at Mega Fund, Scrum Scaling, Scaling at Medcin soft. Rules: Sprint Planning Meeting, Daily Scrum Meeting, Sprint, Sprint Review Meeting, Sprint Retrospective meeting.

Practice:

1. Create and manage Scrum artifacts (Product Backlog, Sprint Backlog, Burndown Chart) for a project.
2. Simulate Sprint Planning, Daily Stand-ups, Sprint Review, and Retrospective meetings.

Additional Practice:

1. Diagnose your team with the Scrum Team Survey.
2. Configure the Jenkins tool with the required paths, path variables, users and pipeline views.
3. Write a build script to build the application using a build automation tool like Maven. Create a folder structure that will run the build script and invoke the various software development build stages. This script should invoke the static analysis tool and unit testcases & deploy the application to a web application server like Tomcat.

Text Books:

1. Agile Project Management with Scrum, Ken Schwaber, 1st Edition,Microsoft Press, ISBN**:** 978-0735619937.
2. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, ISBN: 978-1942788003.

Reference Books:

1. Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Hazzaand Dubinsky, Springer, ISBN: 978-3319251319.
2. What is Devops? Infrastructure as code, 1st Edition, Mike Loukides ,O'Reilly Publications, ISBN: 978-1491924358.
3. Agile Software Development, Cockburn,Highsmith, AlistairCockburnSeries, Addison-Wesley, ISBN: 978-0321249166.

Web Links:

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

CLOUD COMPUTING

Course Code: 243MC014

L	T	P	C
3	0	0	3

Course Outcomes:

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

- **CO1:** Explore the various service and deployment models in cloud computing.
- **CO2:** Demonstrate the basic concepts of virtualization and implementation levels of Virtualization.
- **CO3:** Illustrate the architecture of cloud computing.
- **CO4:** Apply the Cloud programming and software environments on any real cloud service.
- **CO5:** Analyse the Cloud Security risks and Mechanisms.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	2	-	-
CO3	1	-	-
CO4	-	1	1
CO5	-	2	2

UNIT – I

Introduction to Cloud Computing: Cloud models, Evolution of Cloud Computing, System models for Distributed and Cloud Computing, Cloud Computing Properties and Characteristics, Business Drivers for Adopting Cloud Computing, Software environments for distributed systems and clouds, Performance, Security And Energy Efficiency.

UNIT – II

Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structures/ Tools and mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data Centre Automation,Technology Examples like Xen: Paravirtualization, VMware: Full Virtualization, Microsoft Hyper-V.

UNIT – III

Cloud Platform Architecture: Cloud Computing and service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, Inter Cloud Resource Management, Cloud Security and Trust Management. Service Oriented Architecture, Message Oriented Middleware.

UNIT – IV

Programming Model: Parallel and Distributed Programming Paradigms, Map Reduce, Twister and Iterative MaP Reduce, Hadoop Library from Apache, Mapping Applications, Programming Support.

Security in The Cloud: Security Overview, Cloud Security Challenges, Access control mechanisms, Security Governance, Risk Management, Security Monitoring, Security Architecture Design, Virtual Machine Security.

UNIT – V

Cloud Resource Management and Scheduling: Policies and Mechanisms for Resource Management Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds, Fair Queuing, Start Time Fair Queuing, Borrowed Virtual Time, Cloud Scheduling Subject to Deadlines, Scheduling MapReduce Applications Subject to Deadlines.

Text Books:

1. Cloud Computing: Principles, Systems and Applications- Nick Antonopoulos, Lee Gillam; Springer Publication; ISBN: 978-1-84882-889-1
2. Cloud Computing: Concepts, Technology & Architecture - Thomas Erl, Zaigham Mahmood, Ricardo Puttini; Prentice Hall Publication; ISBN: 978-0-13-338752-0

Reference Books:

1. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things - Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra; 1st Edition; Morgan Kaufmann Publishers; ISBN: 978-0-12-385880-8
2. Cloud Computing: Theory and Practice - Dan C. Marinescu; 1st Edition; Publication- Elsevier; ISBN: 978-0-12-404627-4

Web Links:

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

API AND MICROSERVICES

Course Code: 243MC015	L	T	P	C
	1	0	2	3

Course Outcomes:

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

CO1: Develop a Spring Data JPA application with Spring Boot.

CO2: Implement CRUD operations, pagination and sorting mechanism using Spring Data JPA.

CO3: Implement a custom repository to customize a querying mechanism using Spring Data JPA.

CO4: Implement Spring Transaction using Spring Data JPA.

CO5: Spring-based REST endpoints with URI parameters, and clients for consuming REST services programmatically, are developed.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2

UNIT – I

Spring 5 Basics : Why Spring, What is Spring Framework, Spring Framework - Modules, Configuring IoC container using Java-based configuration, Introduction to Dependency Injection, Constructor Injection, Setter Injection, what is Auto Scanning.

Practice:

1. Basic Spring Application with Constructor Injection.
2. Spring Application with Setter Injection.
3. Spring Auto Scanning Example.

UNIT – II

Spring Boot: Creating a Spring Boot Application, Spring Boot Application Annotation, What is Auto wiring, Scope of a bean, Logger, Introduction to Spring AOP, Implementing AOP advice, Best Practices: Spring Boot Application.

Practice:

1. Basic Spring Boot Application with Auto-Wiring and Bean Scopes.
2. Logging with Spring Boot
3. Implementing and Using AOP in Spring Boot

UNIT – III

Spring Data Jpa with Boot: Limitations of JDBC API, Why Spring Data JPA, Spring Data JPA with Spring Boot, Spring Data JPA Configuration, Pagination and Sorting, Query Approaches, Named Queries and Query, Why Spring Transaction, Spring Declarative Transaction, Update Operation in Spring Data JPA, Custom Repository Implementation, Best Practices-Spring Data JPA.

Practice:

1. Basic Spring Boot Application with Spring Data JPA
2. Pagination and Sorting in Spring Data JPA
3. Implementing AOP for Logging with Spring Data JPA

UNIT – IV

Web Services: Why Web services, SOA-Service Oriented Architecture, What are Web Services, Types of Web Services, SOAP based Web Services, REST ful WebServices, How to create REST ful Services.

Practice:

1. Basic RESTful Web Service
2. Pagination and Sorting in RESTful Web Service
3. SOAP-Based Web Service

UNIT – V

Spring Rest: Spring REST - An Introduction, Creating a Spring REST Controller, @RequestBody and ResponseEntity, Parameter Injection, Usage of @PathVariable, @RequestParam and @MatrixVariable, Exception Handling, Data Validation, Creating a REST Client, Versioning a Spring REST endpoint, Enabling CORS in Spring REST, Securing Spring REST endpoints.

Practice:

1. Basic Spring REST Controller
2. Exception Handling and Data Validation
3. Creating a REST Client and Handling CORS

Additional Practice:

1. Building a Simple CRUD Application with Spring Boot and Spring Data JPA.
2. Building a Secure RESTful API with CORS and Versioning

Text Books:

1. "Spring in Action" by Craig Walls and Ryan Breidenbach, 5th edition, by Manning Publications, ISBN:978-161729494.
2. "API and Microservices: Development, Deployment, and Integration", by Pethuru Raj, Anupama Raman, 1st Edition, Wiley publication, ISBN: 978-1119563494.

Reference Books:

1. "Designing Web APIs: Building APIs That Developers Love" , Brenda Jin, Saurabh Sahni, Amir Shevat, 1st Edition , O'Reilly Media, 978-1492026924.
2. "Microservices: Up and Running: A Step-by-Step Guide to Building a Microservice Architecture", Ronnie Mitra, Irakli Nadareishvili, 1st 2020, O'Reilly Media, 978-1492075458.

Web Links:

1. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012966890562117632 72_shared/
2. https://infyspringboard.onwingspan.com/en/app/toc/lex_4313461831752789500_shar ed/
3. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012731900963905536 190_shared /

INFORMATION RETRIEVAL SYSTEMS

Course Code: 243MC016	L	T	P	C
	3	0	0	3

Course Outcomes:

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

- **CO1:** Ability to apply IR principles to locate relevant information in large collections of data.
- **CO2:** Ability to design different document clustering algorithms.
- **CO3:** Implement retrieval systems for web search tasks.
- **CO4:** Design an Information Retrieval System for web search tasks.
- **CO5:** Understand principles of text search techniques and Multimedia Information Retrieval.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1:	2	-	-
CO2:	-	2	2
CO3:	-	-	-
CO4:	-	-	-
CO5:	-	-	-

UNIT – I

Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses

Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities

UNIT – II

Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction

Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models

UNIT – III

Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages

Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters

UNIT – IV

User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext

Information Visualization: Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies

UNIT – V

Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems

Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval

Text Books:

1. "Multimedia Information Retrieval": Content-Based Information Retrieval from Large Text and Audio Databases" 1st Edition, by Peter Schäuble. ISBN-13: 978-0262023485.
2. "Information Storage and Retrieval Systems" – Theory and Implementation, 2nd Edition, Gerald J. Kowalski, Mark T. Maybury, Springer. ISBN-13: 978-0387406038.

Reference Books:

1. Information Retrieval Data Structures and Algorithms, 1st Edition, Prentice Hall. Frakes, W.B., Ricardo Baeza-Yates: ISBN-13: 978-0131661999
2. Information Storage & Retrieval , 1st Edition, By Robert Korfhage – John Wiley & Sons. ISBN-13: 978-0471048688.
3. "Intelligent Multimedia Information Retrieval", 1st Edition, by Giorgio Giunchiglia, Fausto Giunchiglia, and Enrico Blanzieri. ISBN-13: 978-3540186813.

Web Links:

1. https://www-nlp.stanford.edu/IR-book/
2. https://www.geeksforgeeks.org/what-is-information-retrieval/
3. https://www.tutorialspoint.com/natural_language_processing/natural_language_processing_information_retrieval.htm

RECOMMENDER SYSTEMS

Course Code: 243MC017	L	T	P	C
	3	0	0	3

Course Outcomes:

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

CO1: To learn the goal and applicability of recommendation system in various fields.
CO2: To acquire knowledge of basics of content-based recommendation system.
CO3: To learn various types of memory based collaborative recommendation techniques.
CO4: To develop skills of ensemble and hybrid recommendation systems.
CO5: To develop skills of ensemble and hybrid recommendation systems.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	2	3	-
CO3	-	2	3
CO4	-	3	3
CO5	3	-	3

UNIT – I

Recommender Systems Function, Recommendation Techniques, Recommender Systems as a Multi-Desciplinary Field,Challenges.

UNIT – II

Basic Components of Content-Based Systems, Preprocessing and Feature Extraction, Learning User Profiles and Filtering, Nearest Neighbor Classification.

UNIT – III

User-Based collaborative filtering, Similarity Function Variants, Variants of the Prediction Function, Item-Based Collaborative filtering, Comparing User-Based and Item-Based Methods, Strengths and Weaknesses of Neighborhood-Based Methods.

UNIT – IV

Rule-Based Collaborative Filtering, Association Rules, Naive Bayes Collaborativ Filtering, Neural Network, Singular Value Decomposition, Stochastic Gradient Descent, Regularization.

UNIT – V

Weighted Hybrids, Switching Hybrids, Cascade Hybrids, Feature Augmentation Hybrids, Meta-Level Hybrids, Feature Combination Hybrids.

Text Books:

1. Recommender Systems Handbook: 1st Edition, Francesco Ricci, Lior Rokach, Bracha Shapira, Paul B. Kantor, Publisher: Springer. ISBN: 978-1461422070.
2. Recommender Systems: The Textbook. 1st Edition, Charu C. Aggarwal, Springer. ISBN: 978-3319260070.

Reference Books:

1. Recommender Systems: An Introduction, 1st Edition, by Dietmar Jannach, Markus Zanker, Alexander Felfernig, Gerhard Friedrich, Publisher: Cambridge University Press. ISBN: 978-0521493369.
2. Introduction to Information Retrieval, 1st Edition, Authors: Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, Publisher: Cambridge University Press. ISBN: 978-0521865715
3. Collaborative Filtering Recommender Systems, 1st Edition, Authors: Michael D. Ekstrand, John T. Riedl, Joseph A. Konstan. ISBN: 978-1601986276.
4. Recommender Systems Handbook. 2nd Edition, Francesco Ricci, Lior Rokach, Bracha Shapira, Paul B. Kantor, Springer. ISBN-13: 978-1493938491.

Web Links:

1. https://www.coursera.org/learn/recommender-systems
2. https://towardsdatascience.com/the-netflix-prize-and-recommender-systems-439fcd33f1e9
3. https://medium.com/syncedreview/recommender-systems-in-practice-e-commerce-movies-and-music-64d51e88937
4. https://www.datacamp.com/community/tutorials/recommender-systems-python
5. https://towardsdatascience.com/evaluation-metrics-for-recommender-systems-df56c6611093

NEURAL NETWORKS

Course Code: 243MC018	L	T	P	C
	3	0	0	3

Course Outcomes:

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

CO1: Understand Neural Network Fundamentals.
CO2: Master Learning Processes in Neural Networks.
CO3: Apply Perceptron Models.
CO4: Implement Multilayer Perceptrons and Backpropagation.
CO5: Explore Advanced Neural Network Concepts.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	1	2	2
CO2	2	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

UNIT – I

Introduction: What is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks.

Learning Process 1: Error Correction learning, Memory based learning, Hebbianlearing.

UNIT – II

Learning Process 2: Competitive, Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process.

Single Layer Perceptrons - Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perception -convergence theorem, Relation between perception and Bayes classifier for a Gaussian Environment.

UNIT – III

Multilayer Perceptron: Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Computer experiment, feature detection,

Back Propagation: back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, Accelerated convergence, supervised learning.

UNIT – IV

Self Organization Maps: Two basic feature mapping models, Self-organization map, SOM algorithm, properties of feature map, computer simulations, learning vector quantization, Adaptive patter classification, Hierarchal Vector quantilizer, contexmel Maps.

UNIT – V

Neurodynamics: Dynamical systems, stavility of equilibrium states, attractors, neurodynamical models, manipulation of attractors' as a recurrent network paradigm. HOPFIELD MODELS -Hopfield models, computer experiment I.

Text Books:

1. Neural networks a comprehensive foundations, Simon Hhaykin, Pearson Education 2nd Edition. ISBN-13: 978-0131471399.
2. Artificial neural networks, 1st Edition, B.Vegnanarayana Prentice Halll of India P Ltd., ISBN-13: 978-0131531518.

Reference Books:

1. Neural networks in Computer intelligence, 1st Edition, Li Min Fu TMH., ISBN-13: 978-0070260067.
2. Neural networks,1st Edition, Pearson Education, James A Freeman David M S Kapura ISBN-13: 978-0201544350.
3. Bishop, C. M.. Neural Networks for Pattern Recognition. 1st Edition, Oxford University Press. ISBN-13: 978-0198538646.

Web Links:

1. https://onlinecourses.nptel.ac.in/noc19_ee53/preview
2. https://webreference.com/ai/neural-networks/
3. http://neuralnetworksanddeeplearning.com/
4. https://www.geeksforgeeks.org/neural-networks-a-beginners-guide/

DEEP LEARNING

Course Code: 243MC019	L	T	P	C
	2	0	1	3

Course Outcomes:

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

- **CO1:** Understand the basics of neural networks and their use in deep learning.
- **CO2:** Learn to implement and use convolutional neural networks for image analysis.
- **CO3:** Gain skills in implementing recurrent neural networks for sequential data tasks.
- **CO4:** Learn about autoencoders, variational autoencoders, and generative adversarial networks for unsupervised learning.
- **CO5:** Explore restricted Boltzmann machines and their applications in pattern recognition and data representation.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	3	2	2
CO2	2	3	3
CO3	2	-	-
CO4	1	2	2
CO5	2	1	1

UNIT – I

Fundamentals of Deep Networks: Neural networks, Training neural networks, Defining Deep Learning, Common architectural principles of Deep Networks-Parameters, Layers, Activation functions, Loss functions, Hyper parameters, Building blocks of Deep Networks-RBMs, and Auto encoders.

Practice:

1. Implement a simple feedforward neural network using a library like TensorFlow or PyTorch.
2. Experiment with different activation functions (e.g., sigmoid, tanh, ReLU) and observe their impact on training.
3. Explore the impact of hyperparameters on the performance of a deep neural network.

UNIT – II

Convolutional Neural Network: Introduction - components of CNN Architecture - Rectified Linear Unit (ReLU) Layer -Exponential Linear Unit (ELU, or SELU) - Unique Properties of CNN -Architectures of CNN -Applications of CNN.

Practice:

1. Implement a basic CNN architecture using TensorFlow or Keras.
2. Visualize the filters learned by different convolutional layers in a trained CNN.

UNIT – III

Recurrent Neural Network: Introduction- The Architecture of Recurrent Neural Network- The Challenges of Training Recurrent Networks- Echo-State Networks- Long Short-Term Memory (LSTM) - Applications of RNN.

Practice:

1. Implement a basic RNN model using TensorFlow or PyTorch for text generation.
2. Use an RNN (e.g., LSTM) to predict future values in a time series dataset.

UNIT – IV

Deep Unsupervised Learning: Auto encoders (standard, sparse, denoising, contractive, etc), variational Auto encoders, denoising encoders, Adversarial Generative Networks.

Practice:

1. Implement a basic GAN architecture using TensorFlow or PyTorch.

UNIT – V

Deep Belief Networks: Energy Based Models, Restricted Boltzmann Machines, Sampling in an RBM. Applications of deep neural networks in handwritten character recognition, face recognition, semantic web, social networks.

Practice:

1. Implement an RBM using libraries like TensorFlow or PyTorch.
2. Use a pre-trained deep neural network (e.g., CNN or RNN) to recognize handwritten characters from the MNIST dataset.

Text Books:

1. Deep Learning - Ian Goodfellow, Yoshua Bengio, Aaron Courville, 1st Edition, The MIT Press publication, ISBN-10: 0262035618, ISBN-13: 978-0262035613
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems - Aurélien Géron, Edition 3, O'Reilly Media Publication on 2022-11-08, ISBN-13: 9781098125974, ISBN-10: 1098125975

Reference Books:

1. Dive into Deep Learning - Aston Zhang, Zachary C. Lipton, Mu Li, Alexander J. Smola, 1st Edition, Cambridge University Press on 2023, ISBN-13: 9781009389433
2. Deep Learning: Foundations and Concepts - K. Taylor, 1st Edition, Publisher: Springer, Publication Date: 2023, ISBN-13: 9783031454677, ISBN-10: 3031454677

Web Links:

1. http://deeplearning.stanford.edu/tutorial/
2. https://nptel.ac.in/courses/106/106/106106184/
3. https://www.coursera.org/specializations/deep-learning
4. https://www.geeksforgeeks.org/introduction-deep-learning/
5. https://www.deeplearningbook.org

NATURAL LANGUAGE PROCESSING

Course Code: 243MC020	L	T	P	C
	3	0	0	3

Course Outcomes:

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

- **CO1:** Understand the fundamentals and applications of NLP using NLTK and context-free grammar.
- **CO2:** Perform syntactic analysis and ambiguity resolution using pre-processing techniques.
- **CO3:** Implement feature engineering techniques and NLP algorithms for parsers.
- **CO4:** Apply TFIDF, Vectorization, and advanced feature engineering for NLP tasks.
- **CO5:** Explain text summarization and sentiment analysis, and explore unsupervised methods.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	3	1	1
CO2	2	3	3
CO3	-	3	3
CO4	3	2	2
CO5	1	3	3

UNIT – I

Overview of Natural Language Processing: Natural Language Processing and Python: Understanding Natural language Processing and applications, NLTK, Corpus and Dataset, understanding structure of sentence Defining Context free grammar, Morphological Analysis NLP Applications -NLP hard Ambiguity- Algorithms and models, Knowledge Bottlenecks in NLP-Introduction to NLTK, Case study.

UNIT – II

Syntactic Analysis and Semantic Analysis: Ambiguity resolution, Discourse integration, Preprocessing tokenization, stemming, lemmatization, Word tokenization and lemmatization

Parsing and Syntax: Word Level Analysis: Regular Expressions, Text Normalization, Edit Distance, Parsing and Syntax-Spelling, Error Detection and correction-Words and Word Classes-Part-of speech Tagging, Naive Bayes and Sentiment Classification: Case study.

UNIT – III

Feature engineering and NLP algorithms parsers, context free grammars, different types of parsers, POS tagging and different types of POS parsers.

Semantic Analysis and Discourse Processing: Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.

UNIT – IV

Basic Statistical Features of NLP: TFIDF, Vectorization Encoders and Decoders, Normalization, Advanced feature engineering and NLP algorithms Basics of Word2Vec

Natural Language Generation: Architecture of NLG Systems, Applications, Machine Translation: Problems in Machine Translation- Machine Translation Approaches- Evaluation of Machine Translation systems. Case study: Characteristics of Indian Languages.

UNIT – V

Rule Based system for NLP, Machine Learning for NLP problems, Applications of NLP Text Summarization, Sentiment Analysis

Unsupervised Methods In NLP: Graphical Models for Sequence Labelling in NLP.

Text Books:

1. "Python Natural Language Processing", Thanaki J, 1st edition,Packt Publishing Ltd, ISBN:978-1787126786.
2. "Speech and Language Processing", Daniel Jurafsky and James H., 2nd Edition, Martin Prentice Hall, ISBN:978-0131873216.

Reference Books:

1. "Foundations of Statistical Natural Language Processing", Cambridge, Manning and Hinrich Schutze, 1st edition, MIT Press, ISBN:978-0262133609.
2. "Speech & language processing" Jurafsky D, 1st edition ,Pearson Education India, ISBN:978-0130950697.
3. "Foundations of Statistical Natural Language Processing"Christopher D. Manning and Hinrich Schütze, 1st edition,MIT Press,ISBN:978-0262133609.

Web Links:

1. https://www.nltk.org/data.html
2. https://www.nlp-fundamentals.com/

FUNDAMENTALS OF DATA SCIENCE

Course Code: 243MC021	L	T	P	C
	2	0	1	3

Course Outcomes:

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

CO1: Apply principles of NumPy and Pandas to the analysis of data.
CO2: Make use of various file formats in loading and storage of data
CO3: Identify and apply the need and importance of preprocessing techniques
CO4: Show the results and present them in apictorial format
CO5: Facilitate new solutions for visualization of datasets by using different plotting techniques.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	1	3	3
CO3	2	1	1
CO4	2	2	2
CO5	1	2	2

UNIT – I

Introduction to Data Science: Need for Data Science – What is Data Science Data Science Process– Business Intelligence and Data Science – Prerequisites for a Data Scientist – Tools and Skills required.

Numpy Basics: The NumPyndarray: A Multidimensional Array Object, Creatingndarrays, DataTypesforndarrays,OperationsbetweenArraysandScalars,BasicIndexingandSlicing,Boolean Indexing, Fancy Indexing, Data Processing Using Arrays, Expressing Conditional Logic as Array Operations,Methodsfor BooleanArrays,Sorting, Unique.

Practice:

1. Creating a NumPy Array
   a. Basic ndarray
   b. Array of zeros
   c. Array of ones
   d. Random numbers in ndarray

UNIT – II

Getting Started With Pandas: Introduction to pandas, Library Architecture, Features, Applications, DataStructures, Series, DataFrame, IndexObjects, Essential Functionality Reindexing, Dropping entries from an axis, Indexing, selection, and filtering, Sorting and

ranking, Summarizing and Computing Descriptive Statistics, Unique Values, Value Counts, Handling Missing Data, filtering out missing data.

Practice:

1. Perform following operations using pandas
   a. Creating dataframe
   b. concat()
   c. Setting conditions
   d. Adding a new column

UNIT – III

Data Loading, Storage, and File Formats: Reading and Writing Data in Text Format, Reading TextFiles in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats, JSON Data, XML and HTML: Web Scraping, Binary Data Formats, Using HDF5 Format, Reading Microsoft Excel Files, Interacting with Databases, Storing and Loading Data in Mongo DB.

Practice:

1. Read the following file formats using pandas
   a. Text files
   b. CSV files
   c. Excel files
   d. JSON files

UNIT – IV

Data Wrangling: Combining and Merging Data Sets, Database style DataFrame Merges, Merging On Index, Concatenating Along an Axis, Combining Data with Overlap , Reshaping and Pivoting, Reshaping With Hierarchical Indexing, DataTransformation, Removing Duplicates, Replacing Values.

Practice:

1. Perform following operations using pandas
   a. Creating dataframe
   b. concat()
   c. Setting conditions
   d. Adding a new column

UNIT – V

Plotting and Visualization: A Brief matplot lib A PIPrimer, Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File, Plotting Functions in pandas, Line Plots, Bar Plots, Histograms and Density Plots, Scatter Plots.

Practice:

1. Perform following visualizations using matplotlib
   a. Bar Graph
   b. Pie Chart
   c. Box Plot
   d. Histogram

Text Books:

1. "Python for Data Analysis" , Wes McKinney, 1st edition, O'REILLY publication, ISBN: 9781449319793.
2. "DoingDataScience" ,RachelSchutt&O'neil, 1st edition, O'REILLY publication, ISBN: 9781449358655.

Reference Books:

1. "DataSciencefromScratch:FirstPrincipleswithPython" ,JoelGrus,O'ReillyMedia,2nd edition, ISBN:978-1492041139.
2. "Learning the Pandas Library: PythonTools for DataMunging, Analysis, and Visualization" MattHarrison, 1st edition, O'Reilly publication, ISBN:978-1533598240.

Web Links:

1. https://www.geeksforgeeks.org/howtobecomeadataanalystcompleteroadmap/
2. https://www.mygreatlearning.com/wiki/Data_Science_and_Predictive_Analytic
3. https://www.w3schools.com

NoSQL DATABASES

Course Code: 243MC022	L	T	P	C
	2	0	1	3

Course Outcomes:

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

- **CO1:** Understand NoSQL databases, perform CRUD operations in NoSQL environments.
- **CO2:** Utilize MongoDB for document storage, CRUD operations, indexing, and aggregation.
- **CO3:** Implement key-value stores (Memcached, Redis) for data storage and retrieval.
- **CO4:** Compare SQL and MongoDB query features, access data in column-oriented databases (HBase), and query Redis data stores.
- **CO5:** Implement indexing in MongoDB, CouchDB, and Apache Cassandra.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	1	3	3
CO3	-	3	3
CO4	2	-	-
CO5	-	1	1

UNIT – I

Introduction to NoSQL: Definition And Introduction, Traditional relational databases vs. NoSQL databases, Types of No SQL databases, Storing and Accessing Data in NoSql databases, Querying in NoSql databases, Evolution and motivation behind NoSQL databases, Characteristics, advantages, and challenges of NoSQL databases Performing Crud Operations, Creating Records, Accessing Data, Updating And Deleting Data.

Practice:

1. Software Installation
2. Write a program to connect to a MongoDB database and perform basic CRUD operations (Create, Read, Update, Delete) on a collection

UNIT – II

Document Stores: Introduction to MongoDB, Importance of NoSQL databases, Data types, Documents, nested Documents, CRUD Operations, Basic cursor methods: map, to Array, pretty, for Each, limit, count, sort, Columnar Databases, Indexing and Aggregation, MongoDB Node JS Drivers and CAP theorem

Practice:

1. Create a program to demonstrate indexing in MongoDB.
2. Develop a program to utilize MongoDB's Aggregation Framework.

UNIT – III

Key Value Databases: What Is a KeyValue Store, KeyValue Store Features, Suitable Use Cases, Understanding Key/Value Stores In Memcached And Redis, Eventually Consistent Non-Relational Databases.,When Not to Use.

Document Databases: What Is a Document Database, Features, Suitable Use Cases, When Not to Use NoSQL Data Bases.

Practice:

1. Write a program to create a simple keyvalue store that allows users to store and retrieve data using keys.
2. Implement functions to insert keyvalue pairs, retrieve values by key, update values, and delete keyvalue pairs.

UNIT – IV

NoSQL Stores: Similarities Between Sql And Mongodb Query Features, Accessing Data From Column-Oriented Databases Like Hbase, Querying Redis Data Stores, Changing Document Databases, Schema Evolution In ColumnOriented Databases, Hbase Data Import And Export, Data Evolution In Key/Value Stores.

Practice:

1. Design and create a column-oriented table schema in HBase.
2. Store and retrieve key/value pairs in Redis.
3. Perform basic data operations (SET, GET, DEL) and implement more complex

UNIT – V

Indexing and Ordering Data Sets: Essential Concepts Behind A Database Index, Indexing And Ordering In Mongodb, Creating and Using Indexes In Mongodb, Indexing And Ordering In Couchdb, Indexing In Apache Cassandra.

Practice:

1. Create a collection and insert sample documents.
2. Create indexes on single fields, compound indexes (multiple fields), and multikey indexes (arrays).

Text Books:

1. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence" by Pramod J. Sadalage and Martin Fowler,Addison-Wesley, ISBN**:** 978-0321826626
2. Making Sense of NoSQL, Dan McCreary and Ann Kelly, 1st EditionManning Publications**,** ISBN: 978-1617290651.

Reference Books:

1. "Learning NoSQL" by Rik Van Bruggen, Packt Publishing, ISBN: 978-1782160677
2. Professional NoSQL , Shashank Tiwari, 1st Edition,Wrox Press,Wiley, ISBN: 978-0-470-94224-
3. Getting Started with NoSQL, Gaurav Vaish, 1st Edition, Packt Publishing, ISBN: 978-1782161315.

Web Links:

1. https://www.coursera.org/courses?query=nosql
2. https://www.edx.org/learn/nosql
3. https://www.udemy.com/topic/nosql/

BIG DATA ANALYTICS

Course Code: 243MC023	L	T	P	C
	3	0	0	3

Course Outcomes:

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

- **CO1:** Understand the fundamentals, characteristics, and challenges of big data and the Hadoop Ecosystem.
- **CO2:** Use various techniques for mining data stream.
- **CO3:** Demonstrate Building blocks of Hadoop.
- **CO4:** Make use of Pig and Hive to structure and work with big Data.
- **CO5:** Evaluate and implement NoSQL databases and visualization techniques.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	3	2	2
CO3	1	-	-
CO4	-	2	2
CO5	3	3	3

UNIT – I

Introduction to Big Data: What is big data, why big data, Evolution of Big data, Best Practices for Big data Analytics, Big data characteristics, Validating, The Promotion of the Value of Big Data, Big Data Use Cases, Characteristics of Big Data Applications, Understanding Big Data Storage, A General Overview of High, Performance Architecture, HDFS, MapReduce and YARN, Map Reduce Programming Model. Features of big data, big data challenges, Hadoop and its features

UNIT-II

Stream Processing: 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.

UNIT – III

Introduction to Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analysing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, developing a Map Reduce Application,

How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment.

UNIT – IV

Pig: Hadoop Programming Made Easier: Admiring the Pig Architecture, going with the Pig Latin Application Flow, working through the ABCs of Pig Latin, Checking out the Pig Script Interfaces, Scripting with Pig Latin. Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works with examples, Querying and Analyzing Data.

UNIT – V

SPARK: Installing Spark, Spark applications, Jobs, stages and Tasks, Resilient Distributed data sets, Shared Variables, Anatomy of a Spark job run.

NoSQL Data Management For Big Data and Visualization, Nosql Databases:
Schema-less Models, Increasing Flexibility for Data Manipulation, Key Value Stores, Document Store, Tabular Stores, Object Data Stores, Graph Databases Hive, Sharding, HBase, analysing big data with twitter, Big data for E- Commerce Big data for blogs, Review of Basic Data Analytic Methods using R

Text Books:

1. Hadoop: The Definitive Guide, Tom White, O'Reilly, 4th Edition, ISBN: 978-1491901632
2. Hadoop for Dummies, Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk, Bruce Brown, Rafael Coss, John Wiley & Sons, ISBN: 978-1118727128.

Reference Books:

1. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, John Wiley& sons, ISBN: 978-1118224912.
2. Harness the Power of Big Data:The IBM Big Data Platform, Paul Zikopoulos, DirkdeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, Tata McGraw Hill Publications, ISBN: 9780071808187.
3. Learning Spark: Lightning-Fast Big Data Analysis Paperback, Holden Karau, ISBN: 978-1449358624.

Web Links:

1. https://www.coursera.org/courses?query=big%20data%20analytics&page=1
2. https://www.edx.org/learn/big-data
3. https://www.tutorialspoint.com/hadoop/index.htm

DATA VISUALIZATION

Course Code: 243MC024	L	T	P	C
	2	0	1	3

Course Outcomes:

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

CO1: Understand the various types of data, apply and evaluate the principles of data visualization

CO2: Acquire skills to apply visualization techniques to a problem and its associated dataset

CO3: Apply structured approach to create effective visualizations

CO4: Learn how to bring valuable insight from the massive dataset using visualization.

CO5: Learn how to build visualization dashboard to support decision making

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	-	1	1
CO2	-	2	2
CO3	-	2	2
CO4	-	2	2
CO5	-	2	2

UNIT – I

Introduction to Visualization: Introduction to Data Visualizations and Perception: Introduction to visualization and visual perception, visual representation of data, Gestalt principles, Information overload.

Practice:

1. Introduction to various Data Visualization tools
2. Basic Visualization in Python

UNIT – II

Visual Representations: Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

Practice:

1. Basic Visualization in R
2. Introduction to Tableau and Installation

UNIT – III

Classification of Visualization Systems: Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multidimensional data, text and text documents.

Practice:

1. Connecting to Data and preparing data for visualization in Tableau
2. Data Aggregation and Statistical functions in Tableau

UNIT – IV

Visualization of Groups: Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization. Various visualization techniques, data structures used in data visualization.

Practice:

1. Data Visualizations in Tableau

UNIT – V

Visualization of Volumetric Data and Evaluation of Visualizations: Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, evaluating visualizations

Practice:

1. Basic Dashboards in Tableau

Text Books:

1. Interactive Data Visualization: Foundations, Techniques, and Applications. Natick, Ward, Grinstein, Keim, 2nd edition,A K Peters, Ltd. ISBN-10: 1482257995
2. Modern Data Visualization with R , Robert kabacoff, 1st Edition,O'Reilly Media, 2020 ISBN-10**:** 1492071143

Reference Books:

1. Visualization Analysis & Design , Tamara Munzner,1st edition,AK Peters Visualization Series, ISBN-10**:** 1466508190
2. Interactive Data Visualization for the Web , Scott Murray,2nd Edition,MGH, ISBN-10: 1491921288.

Web Links:

1. https://elearn.nptel.ac.in/shop/iitworkshops/completed/datavisualizationwithr/?v=c86ee0d9d7ed
2. https://efaidnbmnnnibpcajpcglclefindmkaj/https://www.cs.put.poznan.pl/jstefanowski/sed/DM14-visualisation.pdf
3. https://www.tutorialspoint.com/business_writing_skills/data_visualization.htm
   https://www.geeksforgeeks.org/datavisualizationanditsimportance/

BUSINESS INTELLIGENCE AND ANALYTICS

Course Code: 243MC025

L	T	P	C
3	0	0	3

Course Outcomes:

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

- **CO1:** Explain the Business Intelligence, Analytics and Decision Support system
- **CO2:** List the technologies for Decision making, Automated decision systems
- **CO3:** Explain sentiment analysis techniques
- **CO4:** Illustrate Multicriteria Decision making systems, predictive modelling techniques
- **CO5:** Evaluate and validate the performance of automated decision systems and expert systems.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	1	2	2
CO3	2	2	2
CO4	1	1	1
CO5	1	-	-

UNIT – I

An Overview of Business Intelligence, Analytics, and Decision Support: Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics.

UNIT – II

Decision Making: Introduction and Definitions, Phases of the Decision, Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components.

UNIT – III

Neural Networks and Sentiment Analysis: Basic Concepts of Neural Networks, Developing Neural NetworkBased Systems, Illuminating the Black Box of ANN with Sensitivity, Support Vector Machines, A Process Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction, Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process,, Sentiment Analysis, Speech Analytics

UNIT – IV

Modelbased Decision Making: Decision Support Systems modeling, Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk, Decision modeling with spreadsheets,Mathematical programming optimization, Decision Analysis with Decision Tables and Decision Trees, MultiCriteria Decision Making With Pairwise Comparisons

UNIT – V

Automated Decision Systems and Expert Systems: Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems.

Text Books:

1. Business Intelligence and Analytics: System for Decision Support" - Ramesh Sharda, Dursun Delen, EfraimTurban, J.E.Aronson,TingPeng Liang, David King, 10th Edition, Pearson Global Edition, ISBN: 978-1292220543
2. "Business Intelligence and Analytics and Data Science" Ramesh sharda, 4 th edition, Pearson Education, ISBN: 978-0134633282

Reference Books:

1. "Data Analytics: The Ultimate Beginner's Guide to Data Analytics Paperback", Edward Mize,1ST edition, CreateSpace Independent Publishing Platform, ISBN: 978-1979636986 .
2. "Business Intelligence and Analytics Hard cover", Drew Bentely , 1st Edition, Larsen & Keller Education, ISBN: 978-1635490051

Web Links:

1. https://onlinecourses.nptel.ac.in/noc24_cs65/preview
2. https://www.geeksforgeeks.com

ETHICAL HACKING

Course Code: 243MC026

L	T	P	C
2	0	1	3

Course Outcomes:

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

CO1: Understand the fundamentals of ethical hacking and networking.
CO2: Perform foot printing, scanning, and enumeration techniques.
CO3: Identify and exploit system vulnerabilities and understand malware threats.
CO4: Assess web application and wireless network security.
CO5: Utilize cryptographic techniques, ethical hacking tools, and document findings effectively.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2

UNIT – I

Introduction to Hacking: Hacking, Types and phases of hacking, Introduction to Ports & Protocols: Ports, Protocols, Primary Network Types, Virtualization & Introduction to Kali Linux: Virtualization, Virtualization software, supported platforms, Introduction to **Penetration Testing:** Penetration test, Categories and Types of Penetration tests, Structure of Penetration Test Report.

Practice:

1. Vulnerable Machines and Environments.
2. Damn Vulnerable Web Application (DVWA)

UNIT – II

Footprinting: Footprinting, Types, Using ping and ns Lookup commands in Windows command line, Scanning: Scanning, Basics of Scanning, Basic Techniques of Scanning, Enumerating DNS using dns enum, Performing flag scan using hping3.

Practice:

1. Online Platforms with Built-in Labs
2. Hack The Box (HTB)
3. TryHackMe
4. Root Me

UNIT – III

Hacking into System: System Hacking, Password Cracking, Default password databases, Manual and Automated Password Cracking, Process of System Hacking, Using Keyloggers, Trojans & Backdoors: Trojans, Working of Trojan, Infection Techniques, Attack, Lifecycle and Classification of Virus.

Practice:

1. CTF (Capture The Flag) Challenges

UNIT – IV

Sniffing, Packet Analysis & Session Hijacking: Sniffing, Packet Analysis, Types of Sniffing, Active and Passive Sniffing Techniques, Session Hijacking, Social Engineering: Social Engineering, Process, Identity Theft, Human and Computer Based Social Engineering Techniques, Phishing Process, Types of Phishing Attacks, Social Engineering Toolkit (SET)

Practice:

1. Local Lab Setups
2. Kali Linux
3. Parrot Security OS
4. VirtualBox or VMware

UNIT – V

Cryptography: Cryptography, Digital Signature, Hash Functions, Steganography: Steganography Process, watermarking, Steganography Methods and Attacks, Steganography tools, Vulnerability Assessment: Vulnerability, The Open Web Application Security Project (OWASP), Prevention, Damn Vulnerable Web Application (DVWA), installation and testing of DVWA

Practice:

1. Customizable and Local Lab Setups
2. Python Cryptography Toolkit
3. Cryptography Lab by Microsoft

Text Books:

1. Hacking: Be a Hacker with Ethics, Harsh Bothra, Khanna Publications Ist Edition ISBN: 9386173050.
2. Ethical Hacking and Penetration Testing Guide, Rafay Baloch, ISBN : 9781138436824

Reference Books:

1. Kali Linux Wireless Penetration Testing Beginner's Guide, Vivek Ramachandran, Cameron Buchanan, Packt Publishing ISBN-13. 978-1783280414.
2. SQL Injection Attacks and Defense, 1st Edition, Justin Clarke-Salt, Syngress Publication ISBN-13 :978-1597499637.
3. Mastering Modern Web Penetration Testing, Prakhar Prasad, Packt Publishing ISBN-13: 978-1785284588.

Web Links:

1. http://www.exploit-db.com/
2. www.geeksforgeeks.org/introduction-to-ethical-hacking
3. www.geeksforgeeks.org/ethical-hacking-tutorial

CYBER SECURITY

Course Code: 243MC027

L	T	P	C
3	0	0	3

Course Outcomes:

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

CO1: Understand the classification and legal perspectives of cyber crimes and cyber security.

CO2: Analyze the role of international law and national policies in cyberspace, emphasizing the relevance of cyber forensics in digital evidence investigation.

CO3: Evaluate security challenges and organizational measures for mobile and wireless devices.

CO4: Identify and explain various tools and methods used in cyber crimes, including phishing, malware, and network-based attacks like DDoS and SQL injection.

CO5: Discuss fundamental data privacy concepts and their applications across different domains.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	-	3	3
CO3	2	-	-
CO4	-	3	3
CO5	-	1	1

UNIT – I

Introduction to Cyber Crime: Definition & Origin of the Word, Cyber Crime and Cyber Security, Who are Cyber Criminals, Classification of cyber Crimes, Cyber Crime – Legal and Indian perspective, Cyber Crime and Indian ITA 2000, Global Perspective on cyber-crimes.

Cyber Offences: Introduction, How criminals plan the attacks, Social engineering, Cyber talking, Cyber Café and Cyber Crimes

UNIT – II

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence,Relevance of OSI 7 Layer Model to Computer Forensics, Forensics Analysis of Email, Digital Forensics Lifecycle,

Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

UNIT – III

Cyber Crime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones,

Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT – IV

Tools and Methods used in Cyber Crime: Proxy servers and Anonymisers, Phishing, Password Cracking, Key Loggers, and Spywares, Virus and Worms, Trojan Horses & Backdoors, Steganography, DOS & DDOS Attacks, SQL Injection, Buffer Overflow, Attacks on wireless networks.

Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

UNIT – V

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives - Nina Godbole, Sunit Belpure; 1st Edition; Wiley Publications; ISBN: 978-8126537081
2. Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives - B. B. Gupta, D. P. Agrawal, Haoxiang Wang; 1st Edition; Publication: CRC Press; ISBN: 978-0367337282

Reference Books:

1. Cyber Security Essentials - James Graham, Richard Howard and Ryan Otson; CRC Press; ISBN: 978-0367335356
2. Introduction to Cyber Security - Chwan-Hwa(john) Wu,J. David Irwin; CRC Press T&F Group; ISBN: 978-0367337077

Web Links:

1. https://nptel.ac.in/courses/106/106/106106178
2. https://www.tutorialspoint.com/cyber-security/index.asp
3. https://www.javatpoint.com/cyber-security-tutorial

NETWORK SECURITY AND CRYPTOGRAPHY

Course Code: 243MC028	L	T	P	C
	2	1	0	3

Course Outcomes:

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

CO1: Understand the security fundamentals and Compare various symmetric encryption techniques.

CO2: Summarize the concepts of asymmetric encryption techniques.

CO3: Discuss the functioning of digital signature standards and data integrity.

CO4: Utilize the services provided by the PGP, S/ MIME & SSL, TLS.

CO5: Describe the concept of IP Security.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	3	1	1
CO2	2	2	2
CO3	2	-	-
CO4	1	2	2
CO5	2	1	1

UNIT – I

Basic Principles: Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography.

Symmetric Encryption: Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard, Advanced Encryption Standard.

Practice:

1. Write a program to obtain GCD of two numbers using Euclidean Algorithm
2. Write a C program to implement Shift Cipher

UNIT – II

Asymmetric Encryption: Mathematics of Asymmetric Key Cryptography- Primes, primality Testing, Factorization, Asymmetric Key Cryptography-RSA Cryptosystem, Rabin Cryptosystem, ElGamal Cryptosystem, Elliptic Curve Cryptosystem.

Practice:

1. Write a C program to implement Rabin Cryptosystem

UNIT – III

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions Requirements and Security Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3.

Digital Signatures: Elgamal Digital Signature Scheme, Schnorr Digital Signature, NIST Digital Signature Algorithm.

Practice:

1. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

UNIT – IV

Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates.

User Authentication: User Authentication, Remote User-Authentication Principle, Remote User-Authentication Using Symmetric Encryption, Kerberos, Remote User-Authentication Using Asymmetric Encryption.

Practice:

1. Exchange public keys between a client and a server.
2. Generate a Certificate Signing Request (CSR).

UNIT – V

Electronic Mail Security: Internet Mail Architecture, Email Formats, Email Threats and Comprehensive Email Security, S/MIME.

Ip Security: IP Security Policy, Encapsulating Security Payload, Combining Security Associations Internet Key Exchange.

Practice:

1. Create and send emails in plain text and HTML formats.

Text Books:

1. Cryptography and Network Security -Behrouz A Forouzan, Debdeep Mukhopadhyay ; 3rd Edition; McGraw Hill; ISBN: 978-0070702080
2. Cryptography and Network Security- William Stallings; Global Edition; 7e Pearson; ISBN: 978-0134444284

Reference Books:

1. Network Security and Cryptography - Bernard Meneges, Cengage Learning; First Edition; ISBN: 978-8131514631
2. Cryptography and Network Security – AtulKahate; Second Edition ;Tata McGraw-Hill; ISBN: 978-0070635974

Web Links:

1. https://nptel.ac.in/courses/106105031
2. https://nptel.ac.in/courses/106105162
3. https://www.coursera.org/browse/computer-science
4. https://www.tutorialspoint.com/gsm
5. https://www.sciencedirect.com/science/article/pii/S1877050915019882

BLOCK CHAIN TECHNOLOGIES

Course Code: 243MC029	L	T	P	C
	3	0	0	3

Course Outcomes:

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

- **CO1:** Demonstrate the foundation of the Block Chain technology and understand the processes in payment and funding.
- **CO2:** Choose the present landscape of Block chain implementations and understand Crypto currency markets.
- **CO3:** Review of legal implications using smart contracts.
- **CO4:** Understanding the Ethereum Virtual Machine (EVM):
- **CO5:** Analyze security, privacy, and efficiency of a given block chain system.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	1	-	-
CO3	-	-	-
CO4	2	1	1
CO5	-	1	1

UNIT – I

Introduction: What is Blockchain (BC), public ledgers, BC as public ledgers; BC history - Bitcoin and Cryptocurrency, BC 2.0, Smart contracts; BC architecture – Blocks in BC, transactions and distributed consensus; BC conceptualization - The Chain and the Longest Chain, Cryptocurrency to Blockchain 2.0, Permissioned Model of Blockchain.

UNIT – II

Cryptocurrency: Cryptographic basics for cryptocurrency, A short overview of Hashing, signature schemes, Public Key Cryptography, A basic cryptocurrency.

UNIT – III

Bitcoin: Bitcoin Wallet, Blocks, Merkley Tree, hardness of mining, transaction verifiability, anonymity, forks, double spending, mathematical analysis of properties of Bitcoin. Blockchain Consensus Algorithms – Proof-of-Work (POW), Proof-of-Stake (POS), Delegated POS (DPOS)

UNIT – IV

Ethereum: Ethereum Virtual Machine (EVM),Wallets for Ethereum, Solidity, Smart Contracts, some attacks on smart contracts. Scaling of Blockchains, Future of Blockchains

UNIT – V

Trends and Topics: Zero Knowledge proofs and protocols in Blockchain, Succinct non-interactive argument for Knowledge (SNARK), pairing on Elliptic curves, Zcash.

Text Books:

1. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction",Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Gold feder, 1st Edition, Princeton University Press,ISBN: 978-0691171692.
2. Blockchain:Blue print for aNew Economy, Melanie Swan, O'Reilly, ISBN:1491920475,9781491920473.

Reference Books:

1. Research Perspectives and Challenges for Bitcoin and Cryptocurrency", Joseph Bonneau, Andrew Miller, Jeremy Clark, Arvind Narayanan, Joshua A. Kroll, Edward W. Felten, IEEE Symposium on Security and Privacy.
2. The Bitcoin Backbone Protocol: Analysis and Applications, Juan A. Garay, Aggelos Kiayias, Nikos Leonardos, EUROCRYPT 2015, Part II, Lecture Notes in Computer Science (LNCS), Volume 9057, Springer, ISBN: 978-3662469607
3. Mastering Ethereum: Building Smart Contracts and DApps by Andrews ISBN-13. 978-1491971949.

Web Links:

1. https://builtin.com/blockchain
2. https://www.computerworld.com/article/3191077/what-is-blockchain-the-complete guide.html
3. https://blockgeeks.com/guides/what-is-blockchain-technology/F

SECURE CODING TECHNIQUES

Course Code: 243MC030

L	T	P	C
3	0	0	3

Course Outcomes:

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

CO1: Differentiate the objectives of information security.

CO2: Summarize the trend, reasons and impact of the recent Cyber-attacks.

CO3: Describe OWASP design principles while designing a web application.

CO4: Explain threat modelling and importance of security in all phases of SDLC.

CO5: Write secure coding using some of the practices in C/C++/Java and Python programming languages.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	2	3	3
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2

UNIT – I

Network and Information Security Fundamentals : Network Basics, Network Components, Network Types, Network Communication Types, Introduction to Networking Models, Cyber Security Objectives and Services, Other Terms of Cyber Security, Myths Around Cyber Security, Myths Around Cyber Security, Recent Cyber Attacks, Generic Conclusion about Attacks, Why and What is Cyber Security, Categories of Attack.

UNIT – II

Introduction to Cyber Security: Introduction to OWASP Top 10, A1 Injection, A1 Injection Risks Root Causes and its Mitigation, A1 Injection, A2 Broken Authentication and Session Management, A7 Cross Site Scripting XSS,A3 Sensitive Data Exposure, A5 Broken Access Control, A4 XML External Entity (XEE), A6 Security Misconfiguration, A7 Missing Function Level Access Control, A8 Cross Site Request Forgery CSRF, A8 Insecure Deserialization, A9 Using Components With Known Vulnerabilities, A10 Unvalidated Redirects and Forwards, A10 Insufficient Logging and Monitoring, Secure Coding Practices, Secure Design Principles, Threat Modeling, Microsoft SDL Tool.

UNIT – III

Secure Coding Practices and Owasp Top 10: Declarative Security, Programmatic Security, Concurrency, Configuration, Cryptography, Input and Output Sanitization, Error Handling, Input Validation, Logging and auditing, Session Management, Exception Management, Safe APIs, Type Safety, Memory Management, Tokenizing, Sandboxing, Static and dynamic testing, vulnerability scanning and penetration testing.

UNIT – IV

Secure Coding Practices in C/C++ and Java: Potential Software Risks in C/C++, Defensive coding, Preventative Planning, Clean Code, Iterative Design, Assertions, Pre Post Conditions, Low level design inspections, Unit Tests.

Java- Managing Denial of Service, Securing Information, Data Integrity, Accessibility and Extensibility, Securing Objects, Serialization Security.

UNIT – V

Secure Coding in Python: Interactive Python Scripting, Python Variables, Conditionals, Loops, Functions, External Modules, File operations, Web requests.

Text Books:

1. Networking Fundamentals - Gordon Davies, 2019 edition, Packt Publication, ISBN: 978-1789800937
2. Principles of Information Security - Michael E. Whitman and Herbert J. Mattord, 6th Edition, Course Technology, Cengage Learning publication, ISBN: 978-1337102063

Reference Books:

1. Csslp secure software lifecycle professional all-in-one exam guide, Wm. Arthur Conklin, Daniel Paul Shoemaker, Third Edition, Released February 2022, McGraw-Hill publication, ISBN: 9781264258215
2. OCP Oracle Certified Professional Java SE 11 Programmer II Study Guide: Exam 1Z0-816 and Exam 1Z0-817 - Scott Selikoff, Jeanne Boyarsky, Sybex publication on August 6, 2020, ISBN: 978-1119588214

Web Links:

1. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012683751296065536354_shared/conte
2. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012683751296065536354_shared/conte
3. https://infyspringboard.onwingspan.com/en/viewer/html/lex_auth_013501569657159680916 0
4. https://infyspringboard.onwingspan.com/en/viewer/html/lex_auth_013501568992755712966 0
5. https://infyspringboard.onwingspan.com/en/viewer/html/lex_auth_013501593040977920130 93

APPLIED MODERN TECHNOLOGIES

Course Code: 243MC035	L	T	P	C
	3	0	0	3

Course Outcomes:

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

CO1: Acquire conceptual knowledge about various Information technology-related domains Along with their pros and cons.

CO2: Analyze numerous case studies based on current IT tools and technologies.

CO3: Interpret current and future career perspectives of the existing IT domain.

CO4: Summarize cyber security threats that organizations need to be aware of and learn aboutVarious defense mechanisms.

CO5: Evaluate the innovation that emerging technologies like Blockchains can bring about.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2	PSO3
CO1	3	1	2
CO2	2	3	1
CO3	2	1	2
CO4	1	2	-
CO5	2	-	3

UNIT – I

Artificial Intelligence and Big Data: Introduction of AI & its applications, History of AI, Understanding Data, Application Domains of AI, Workflow of AI Projects, Technical Tools for AI, Evolution & Future of AICareer & Jobs in AI;

Machine Learning- Introduction to ML, Supervised & Unsupervised Learning, Overview of some ML Algorithms;

Deep Learning-Types of Neural Networks, Techniques & Applications of NLP, Overview of NLP Algorithms, Introduction to CV, Deep learning revolution;

Big Data-5v's of Big Data, How Big Data Works, Applications of Big Data, Introduction to Data Engineering, Difference b/w Data Analyst, Data Engineer & Data Scientist
Responsibilities of Data Analyst, Data Engineer, and Data Scientist;
Big Data Frameworks-Introduction to Hadoop, Introduction to Spark, Hadoop vs. Spark

UNIT – II

Cloud Computing Fundamentals: Introduction to Cloud Computing, Definition & Characteristics, Overview of Cloud Infrastructure, I & Cloud Computing on Cloud, Cloud Computing models (Iaas, Paas, Saas

Components of Cloud Computing -Virtualization & Virtual Machine,Containers,Cloud Storage, Content Delivery Networks, Hybrid Multicloud,Microservices,Serverless Computing

Cloud Security & Monitoring-What is cloud security?, Identity & Access Management, Cloud Encryption, Cloud Monitoring

UNIT – III

Internet of Things: Internet of Things (IoT), Introduction of IoT, Features of IoT, Advantages and Disadvantages of IoT, Application in Business & Industry Domain, Future Scope of IoT

IoT Hardware and Software-IoT Devices, Sensors, Microcontrollers, Raspberry Pi, IoT Languages, IoT Framework

UNIT – IV

Block chain: Block chain – Introduction, What is Blockchain, Blockchain Structure, Features of Blockchain, Types of Block chain

Ethereum Block chain-What is different about Ethereum Blockchain?, Smart Contracts Ethereum Structure,Cryptocurrency

UNIT – V

Cyber security and Cloud services: Cyber Security, Types of Cyber Attack, Cyber Attack Counter Measures, Applications of Cyber Security

Cryptography-Cryptography & its Techniques, Types of Cryptography, Cryptography Algorithms Cloud Services Platforms-Amazon Web Services (AWS), Google Cloud Platform (GCP)

Text Books:

1. Artificial Intelligence with Python by Prateek Joshi, 2nd Edition , Packet Publishing**,** ISBN-13: 978-1839219535
2. Cyber security for Beginners by Raef Meeuwisse, 4th Edition, IT Governance Publishing, ISBN-13: 978-1780173405

Reference Books:

1. Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Zaigham Mahmood, and Ricardo Puttini.,1st Edition , Prentice Hall**,** ISBN-13: 978-0133387520.
2. Block chain For Dummies by Tiana Laurence and Don Tapscott , 2nd Edition , For Dummies**,** ISBN-13: 978-1119555018
3. Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security" by Perry Lea, 1st Edition , Packet Publishing, ISBN-13**:** 978-1788470599.
4. Big Data: A Beginner's Guide To Using Data Science For Business by David Feldspar, 1st Edition , Independently published**,** ISBN-13**:** 978-1520719925.

Web Links:

1. https://archive.nptel.ac.in/courses/106/104/106104189/
2. https://onlinecourses.nptel.ac.in/noc22_cs53/preview

WEB DESIGN AND DEVELOPMENT

Course Code: 243MC036	L	T	P	C
	2	0	1	3

Course Outcomes:

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

- **CO1:** Demonstrate a foundational understanding of web development principles
- **CO2:** Master core web development tools and resources and apply best practices for user-friendly web design
- **CO3:** Craft accessible & responsive websites using HTML & CSS
- **CO4:** Leverage JavaScript for basic interactivity
- **CO5:** Collaborate effectively and manage code versions

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2	PSO3
CO1	3	1	2
CO2	2	2	2
CO3	3	-	2
CO4	2	-	2
CO5	-	2	3

UNIT – I

Introduction to Web Design: Introduction to Web and Web Development, Evolution of the web, Different types of websites and their purposes, What is web designing?, Careers in web development, Impact of the web on society and communication, Client-side vs. server-side development, Web development process: planning, coding, testing, and deployment

Web Designing Tools and Resources-Popular web browsers and their developer tools, Online code editors and development environments, Web design resources and tutorials, Identifying website goals and target audience

Needs Analysis and UI/UX Considerations-User interface (UI) and user experience (UX) considerations, Sketching basic website layouts and wireframes

Practice:

1. Create a sitemap outlining the website's structure and form the content for each page (e.g., About Me, Skills, Projects, Contact), Create a GitHub repository for your project and ensure continuous commit for this project
2. Sketch a basic wireframe for each page, visualizing the layout and placement of content elements.
3. Install tools like a code editor (e.g., VS Code) and browser developer tools (e.g., Chrome DevTools) and create a Basic HTML structure (website's main structure using HTML elements like <header>, <nav>, <section>, And<footer>)

UNIT – II

Core Concepts of HTML: Introduction to HTML-What is HTML and its role in web development, Basic HTML structure: elements, attributes, and tags, Importance of semantic HTML for website meaning and accessibility

Common HTML Elements-I-Headings, paragraphs, and lists for structuring content, Images and multimedia elements for visual appeal, Links and anchors for navigation within and between web pages, Tables for data presentation (with a note on responsible use of tables for layout),Forms for user input and data collection, Basic form elements: text fields, radio buttons, checkboxes

Creating Semantic HTML Documents-Importance of using proper HTML tags to convey meaning, Semantic elements for headings, navigation, sections, articles, aside, and more, Building a well-structured and accessible website foundation

Organizing Content with HTML-Nesting of HTML elements to create complex website structures, Using HTML attributes to provide additional information and functionality, creating reusable HTML components for efficient development

Introduction to HTML Validation-Importance of validating HTML code for errors and best practices, Using online validators and developer tools for code-checking, maintaining clean and well-formatted HTML

Building Interactive Forms-Form validation techniques to ensure user input accuracy, Sending form data using different methods (GET vs. POST)), Introduction to form handling on the server side

Practice:

1. Adding Content with Semantic HTML: Focus on using semantic HTML elements like <h1> for headings, <p> for paragraphs, and <ul> for lists to improve website meaning and accessibility.
2. Integrating Images and Links: Incorporate relevant images and links to other web pages or sections within the Website.

UNIT – III

Styling with CSS: Introduction to CSS:What is CSS and its role in web design, Selectors in CSS: targeting elements for styling, Basic CSS properties and values for formatting text and elements

CSS Selectors-I&II-Targeting elements with IDs, classes, and element types, Combining selectors for precise control over styles, Pseudo-classes and pseudo-elements for dynamic styling, Descendant selectors, child selectors, and universal selector, Grouping selectors and nesting for efficient CSS code, Specificity in CSS and resolving conflicts

Formatting Text with CSS-Font properties for controlling font family, size, color, and style, Text alignment, justification, and decoration for visual appeal, Line height and letter spacing for readability

Box Model and Layout in CSS-The CSS box model: understanding content, padding, border, and margin, Layout techniques using CSS: float, clear, and positioning

Backgrounds and Images in CSS-Setting background colors and images for web pages, Background properties: position, size, repeat, and attachment, Using images effectively: optimization, accessibility considerations

Borders and Outlines in CSS-Styling borders with width, style, and color properties, Creating decorative borders and outlines for elements, Using borders for visual separation and grouping

Accessibility Considerations-Importance of building accessible websites using semantic HTML and ARIA attributes, Implementing alternative text for images using the ‘alt’ attribute.,Color contrast and proper heading structure for screen readers.

Practice:

1. Building Forms for Contact: Create a basic contact form with input fields like name, email, and message,Ensuring proper form structure.
2. Design an HTML Learning CSS Selectors: Use CSS selectors to target specific elements within their HTML Document for styling.

UNIT – IV

Advanced CSS: CSS Animations and Transitions: Exploring properties for text shadows, gradients, etc, CSS animations and transitions, Creating simple animations for hover effects, element appearances, or transitions,Exploring animation properties like 'animation-name', 'duration', and 'timing-function'

CSS Frameworks -CSS frameworks like Bootstrap and Foundation, Advantages of using CSS frameworks, Exploring the basic structure and components of a chosen framework (e.g., grid system, navigation bars, buttons),When to consider using a framework vs. writing custom CSS

Advanced CSS Layouts-Introduction to Grid Layout for a more structured approach to layout, Basic Grid concepts: rows, columns, gaps, and grid placement, Introduction to Flex box for flexible layout and responsive design, Exploring basic Flex box properties (display: flex, justify-content, align-items)

Organizing CSS Styles -Internal vs. external style sheets for managing CSS code, Best practices for writing clean, maintainable, and reusable CSS,Using CSS pre-processors like SASS or LESS

Responsive Web Design Fundamentals-Responsive design considerations for different screen sizes ,Using media queries to adapt layouts for different screen sizes, Techniques for creating responsive navigation, images, and content, Advanced Media Query features: device targeting (e.g., (max-width: 768px)),Media query orientation queries (e.g., (orientation: portrait)) and nesting for complex layouts.

Building a Basic Website Layout with CSS-Applying CSS concepts to create a simple website layout, Combining elements and styles for a visually appealing design, Understanding the separation of concerns between HTML and CSS

Practice:

1. Formatting Text and Layouts: Using CS, control text styles (font-family, size, color), margins, padding, and basic layouts using floats.
2. Adding Backgrounds and Images: Use CSS to set background colors and images, style images, and understand Responsive design considerations.
3. Refining the Design: Customize the website's visual appeal by applying color chemes, typography choices, and basic CSS animations

UNIT – V

Introduction to JavaScript, Version Control, and Testing: What is JavaScript and Why Use It?,Introduction to JavaScript as a scripting language for web interactivity, Adding dynamic behavior to web pages with JavaScript

Core JavaScript Concepts-Basic JavaScript syntax: variables, data types, operators, Control flow statements: if-else, loops (for, while), Introduction to functions for code reusability

Event Handling with JavaScript-Responding to user interactions like clicks, scrolls, and form submissions, Event listeners and event handlers for dynamic behavior, Simple examples of event handling in practice

DOM Manipulation with JavaScript-Introduction to the Document Object Model (DOM), Accessing and modifying HTML elements using JavaScript,
Adding, removing, and modifying content dynamically

Introduction to Version Control (Git)-Importance of Git version control for collaborative

development, Basic Git concepts: repositories, commits, branches, and merging, Utilizing a Git client or online platform to manage code versions.

Testing and Debugging Techniques-Importance of testing websites across different browsers and devices for compatibility., Using browser developer tools to inspect and debug web pages., Common CSS debugging techniques for layout and style issues

Practice:

1. Ensuring Responsiveness: Introduce basic media queries in CSS to adapt the website layout for different screen sizes (mobile-friendly design).
2. Validation and Testing: Use online validators to check their HTML and CSS code for errors and test the website functionality across different browsers.
3. Deployment: Explore hosting the website online using free platforms such as GitHub Pages

Text Books:

1. Head First HTML & CSS by Elisabeth Robson & Eric Freeman; 2nd Edition, Shroff/O'Reilly**,** ISBN-13**:** 978-9350238890
2. Web Design for Developers: A Programmer's Guide to Design Tools and Techniques by Brian Hogan; 1st Edition, Publisher: O′Reilly, ISBN-13: 978-1934356135.

Reference Books:

1. Responsive Web Design by Ethan Marcotte; 2nd Edition , Publisher: A Book Apart, ISBN-13**:** 978-1937557188
2. CSS–The Definitive Guide by Eric Meyer, Estelle Weyl; 4th Edition, O′Reilly, ISBN-13: 978-1449393199.
3. The Web Developer's Guide to Completing Projects by Ashley Nolan & Lewis Powell; 1st Edition ,SitePoint, ISBN-13: 978-0995466317.
4. Web Design with HTML, CSS, JavaScript, and jQuery set, by Jon Duckett; Packt Edition, Wiley **,** ISBN-13**:** 978-1118907757.

Web Links:

1. https://www.shiksha.com/online-courses/web-development-courses-certification-training-by-nptel-st644
2. https://www.upwork.com/resources/web-design-vs-web-development

ADVANCED JAVASCRIPT

Course Code: 243MC037

L	T	P	C
2	0	1	3

Course Outcomes:

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

- **CO1:** Analyze the fundamental concepts and syntax of JavaScript.
- **CO2:** Apply JavaScript programming techniques to solve real-world problems.
- **CO3:** Evaluate different JavaScript data types and their appropriate usage.
- **CO4:** Create interactive web applications using JavaScript and DOM manipulation.
- **CO5:** Synthesize advanced JavaScript concepts and techniques to develop robust applications.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2	PSO3
CO1	3	1	-
CO2	2	3	-
CO3	3	-	1
CO4	3	2	2
CO5	1	2	3

UNIT – I

JavaScript Fundamentals: Introduction to JavaScript-Brief history and overview of JavaScript, JavaScript in web development, Basic syntax and structure of a JavaScript program. **Lexical Structure**-Character set and Unicode in JavaScript, Tokens and keywords, Identifiers and variable.

Types, Values, and Variables-Primitive types: number, string, Boolean, null, undefined, symbol, Object types: object, function, array, date, regex, error, Type coercion and conversion

Expressions and Operators-Arithmetic, comparison, logical, bitwise, and assignment operators, Operator precedence and associativity, Expressions and their evaluation.

Statements-Control flow statements: if/else, switch, while, do/while, for, break, continue, Exception handling with try/catch/finally.

Practice:

1. Set up project structure and files.
2. Design the basic HTML structure for the weather application.

UNIT – II

JS Objects, Arrays, Classes and DOM: Functions-Defining and calling functions, Function parameters and arguments, Function scope and closures

Objects-Object literals and properties, Creating objects with constructors and classes, Object methods and this keyword

Arrays-Creating and accessing arrays, Array methods for manipulation and iteration, Arrays and objects

Classes and Modules-Static and instance members, Inheritance and polymorphism,ES6 modules and import/export statements
Regular Expressions-Syntax and basic patterns,Metacharacters and quantifiers, Capturing and non-capturing groups
JavaScript Subsets and Extensions-ECMAScript and its versions, Browser-specific extensions, Server-side JavaScript and Node.js
The Document Object Model-The structure and hierarchy of the DOM, Accessing and manipulating DOM elements, Events and event handling
Practice:

1. Style the HTML elements using CSS for a visually appealing layout..
2. Create an input field where users can enter the name of a city.
3. Implement a JavaScript function to fetch current weather data for the entered city.
4. Style the current weather display section for better presentation.

UNIT – III
JS Scripting & npm: Scripting Web Pages: Embedding JavaScript code in HTML pages, Loading external scripts, Best practices for web page scripting. **Handling Events**-Event types and propagation, Event listeners and handlers, Using event objects and event delegation
Scripting CSS-Dynamic CSS manipulation with JavaScript,CSS selectors and rules
Handling XML-The structure and syntax of XML,Parsing and generating XML documents,XML and JSON comparison.
Scripting HTTP-Overview of the HTTP protocol and its components, HTTP requests and responses, Using the fetch API to make HTTP requests
Node and npm-Installing and using Node.js,Running JavaScript code outside the browser,Node.js modules and packages
Practice:

1. Design an HTML section for displaying the 3-day weather forecast.
2. Implement JavaScript function to generate simulated 3-day weather forecast data for the entered city.
3. Implement geolocation functionality to detect the user's current location (using simulated data).

UNIT – IV
Server Side JS: Server:Side JavaScript with Node-Building a web server with Node.js,Handling HTTP requests and responses,Node.js frameworks for web development
Modules and Packages-The module system in Node.js and ES6,Importing and exporting modules, Creating and publishing packages with npm
File system I/O-Reading and writing files with Node.js,Using the fs module for file system operations, Asynchronous vs. synchronous I/O
Networking-Network protocols and communication,TCP and UDP sockets,WebSocket and real-time communication **Child Processes**-Spawning and managing child processes with Node.js,Inter-process communication and messaging, Forking and clustering for parallel processing. **Tools and Techniques**-Debugging and profiling JavaScript code, Build tools and automation with Grunt and Gulp, Code quality and linting with ESLint
Practice:

1. Fetch weather data based on the user's geolocation (using simulated data) and display the simulated weather Information for the user's current location.
2. Implement basic error handling for invalid city inputs and geolocation errors.
3. Implement a feature to display weather icons corresponding to the current weather conditions (e.g., sunny, Cloudy, rainy).

UNIT – V

Client Side JS and Advanced JS:Client-Side JavaScript Frameworks-Overview of popular client-side frameworks, React, Angular, and Vue.js,Single-page applications and routing

The jQuery Library-Introduction to jQuery and its features, Selectors and DOM manipulation with jQuery, Event handling and animation with jQuery

Ajax and JSON-Asynchronous requests with XMLHttpRequest,JSON data format and parsing, Cross-origin resource sharing (CORS),Scripting Mobile Apps

Web Assembly and WebGL-Introduction to Web Assembly and its benefits, Running C/C++ and other compiled code in the browser, WebGL for high-performance graphics and visualization

Advanced Topics-Promises and async/await, Generators and iterators,Web workers and offloading tasks

Practice:

1. Add additional features such as a toggle switch for temperature units (Celsius / Fahrenheit) or a button to refresh weather data.
2. Integrate a feature to allow users to save their favorite cities and quickly access weather information for those cities without re-entering the names.
3. Ensure basic responsiveness for different screen sizes using CSS media queries.

Text Books:

1. JavaScript: The Definitive Guide by David Flanagan, 7th Edition, O'Reilly Media, ISBN-13: 978-0596000487
2. Eloquent JavaScript: A Modern Introduction to Programming by Marijn Haverbeke, 3rd Edition, No Starch Press, ISBN-13**:** 978-1593279509.

Reference Books:

1. JavaScript: The Good Parts by Douglas Crockford, 1st Edition, O'Reilly Media, ISBN-13**:** 978-0596517748
2. You Don't Know JS: Up & Going by Kyle Simpson, 1st Edition, O'Reilly Media, ISBN-13**:** 978-1491924464
3. JavaScript: The Complete Reference by Thomas A. Powell, 3rd Edition, McGraw-Hill Education**,** ISBN-13: 978-1260454832
4. Head First JavaScript Programming by Eric Freeman and Elisabeth Robson, 1st Edition, O'Reilly Media, ISBN-13: 978-1491904886.

Web Links:

1. https://www.geeksforgeeks.org/advanced-javascript-backend-basics/
2. https://www.w3schools.com/js/

CLIENT- SIDE SCRIPTING

Course Code: 243MC038	L	T	P	C
	2	0	1	3

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

CO1: Create accessible and semantically structured web pages using HTML and ARIA attributes.

CO2: Implement responsive layouts and design using CSS, including flexbox and positioning techniques.

CO3: Develop interactive user interfaces and manage state using React components, props, and state.

CO4: Validate and test React applications, including form validation, unit testing, and end-to-end testing.

CO5: Apply advanced concepts in React, such as server-side rendering (SSR) and state management with Redux.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	1
CO3	3	2	2
CO4	-	3	3
CO5	2	3	2

UNIT – I

Lexical Analysis: HTML Accessibility, Semantic Markup for accessibility, Alternative Text for images, ARIA (Accessible Rich Internet Applications) Attributes, Keyboard Accessibility and Focus Elements

HTML Multimedia-Embedding images, videos, and audio, Video and audio controls, HTML5 Canvas for drawing and animations, Working with SVG (Scalable Vector Graphics)

HTML APIs: Geolocation API, Local storage and session storage, Web workers for multithreading, Drag and drop API

CSS Flexbox: Flex container and flex items, Flex directions and alignment, Flexbox properties: flex-grow, flex-shrink, flex-basis, Flexbox ordering and wrapping, Nested flexbox layouts, Responsive design with Flexbox. **Lecture3a:** CSS Layout, Box model, Positioning elements with CSS,Display properties,CSS units of measurement

CSS Performance Optimization-CSS minification and compression techniques,CSS sprites and image optimization, Critical path CSS optimization,CSS caching and performance tools,CSS performance profiling and debugging

JavaScript Asynchronous Programming-Understanding asynchronous programming, Callback functions and their usage, Error handling with callbacks (e.g.try/catch),Callback hell and how to mitigate it, Promises and their syntax, Chaining promises for asynchronous operations.

Practice:

1. Enhance the accessibility of a movie app webpage, Embed movie trailers or clips.
2. Use the Geolocation API to fetch the user's location and display nearby movie theaters or Cinemas on a movie app webpage, Design a movie app search results page that display Movie cards in a flexbox layout with details such as movie poster, title, and rating.
3. Design the layout of the movie list & booking form, Optimize the performance of a movie app.

UNIT – II

React: Introduction to React, React Components, JSX Syntax, Props and State, React Lifecycle Methods

React Hooks-Use State Hook, use Effect Hook, use Context Hook, use Reducer Hook, Custom Hooks.

Practice:

1. Fetch Movie Data from API.
2. Create a React component for displaying movie cards.
3. Replace class components with functional components and implement use State to Manage movie data and selected movie.

UNIT – III

React Validation & Testing: React Forms and Validation, Controlled Components, Uncontrolled Components, Form Validation, Formik Library, Yup Validation

React Testing-Unit Testing with Jest, Testing React Components, Mocking APIs, Testing Redux, End-to-End Testing with Cypress.

Practice:

1. Create a form for adding new movies to the movie app, including fields for title, poster URL, release date, and genre.
2. Write unit tests for a movie app component.
3. Implement Redux store and actions for managing movie data in a movie app.

UNIT – IV

Rendering with React + Angular Basics: State Management with Redux, Redux Basics, Redux Middleware, Redux Saga, Reselect Library

Server-side Rendering (SSR) with React-SSR Basics,Next.js Framework, Server-side Data Fetching,SEO Optimization

Introduction to angular-Setting up an Angular development environment, Components, directives, and templates in Angular, Data binding in Angular, Angular modules and services

Angular Forms-Form controls and validation, Form submission and handling, Form validation using built-in and custom validators, Dynamic forms and form arrays

Practice:

1. Implement server-side rendering using Next.js in a movie app.
2. Creating Angular Components for Movie App.
3. Creating Movie Search Form.

UNIT – V

Advance Angular concepts: Angular Routing and Navigation, Angular routing concepts, Configuring routes in Angular, Navigation and route guards, Lazy loading and dynamic routing

Angular Components and Directives-Creating custom Angular components, Using Angular built-in components, Component communication and lifecycle hooks, Creating custom Angular directives

Angular Pipes and Filters-Built-in pipes in Angular, Creating custom pipes, Using filters to format data

Angular HTTP and API Integration-Making HTTP requests in Angular, Handling HTTP responses and errors, Interceptors and request caching, Integration with RESTful APIs.

Practice:

1. Implementing Movie Details Page.
2. Creating Movie Card Component, Implementing Movie Search Filter.
3. Adding Movie CRUD Functionality.

Text Books:

1. Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics by Jennifer Niederst Robbins, 5th Edition, O'Reilly Media, ISBN-13: 978-1491960201 .
2. React: Up & Running: Building Web Applications by Stoyan Stefanov and Kiran Prasad, 2nd Edition, O'Reilly Media, ISBN-13: 978-1492051721.
3. Fullstack React: The Complete Guide to ReactJS and Friends" by Anthony Accomazzo, Ari Lerner, Nate Murray, Clay Allsopp, David Guttman, and Tyler McGinnis, 2nd Edition, Fullstack.io, ISBN: 978-0991344625.

Reference Books:

1. JavaScript: The Definitive Guide by David Flanagan, 7th Edition, O'Reilly Media**,** ISBN-13: 978-0596000487.
2. CSS Mastery: Advanced Web Standards Solutions by Andy Budd, 3rd Edition, A Book Apart**,** ISBN-13**:** 978-1937557423 .

Web Links:

1. https://docs.servicenow.com/bundle/washingtondc-application-development/page/script/client-scripts/concept/client-side-scripting-overview.html
2. https://developer.mozilla.org/en-US/docs/Learn/JavaScript

SERVER-SIDE SCRIPTING

Course Code: 243MC039	L	T	P	C
	2	0	1	3

Course Outcomes:

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

CO1: Apply Node.js fundamentals to create basic web applications and APIs.

CO2: Design, develop and deploy scalable backend systems using Node.js

CO3: Analyze and implement advanced Node.js concepts such as real-time applications, testing and debugging, deployment, and security

CO4: Evaluate the benefits of microservices architecture and apply them to build and manage microservices in Node.js

CO5: Integrate Node.js with other server-side technologies to develop efficient and scalable web applications

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	2	1
CO3	2	-	2
CO4	-	3	3
CO5	2	1	2

UNIT – I

Node.js Fundamentals: Introduction to Node.js, Understanding the basics of Node.js, Installing Node.js and npm, Building a Hello World application in Node.js

Node.js Core Modules-Exploring built-in modules in Node.js, Using fs module for file system operations, working with http module for creating a web server, Utilizing path module for working with file paths

Asynchronous Programming in Node.js-Understanding the concept of asynchronous programming, Using callbacks, promises, and async/await in Node.js,Handling errors in asynchronous code, Utilizing the event loop and understanding event-driven architecture in Node.js.

Practice:

1. Build a Hello World application that greets the user with their name.
2. Create a module that fetches movie data from an API and returns it to the application.
3. Fetch Movie data and display it on the console.

UNIT – II

Express.js & Passport.js: Express.js, Introduction to Express.js, a popular Node.js web framework, Building Restful APIs with Express.js,Working with middleware in Express.js for request handling, Implementing routing and handling HTTP requests in Express.js

Data Persistence and Database Integration-Connecting Node.js to databases like MongoDB, MySQL, or PostgreSQL-Using popular Node.js database libraries like Mongoose, Sequelize, or Knex-Performing CRUD (Create, Read, Update, Delete) operations with databases in Node.js

Authentication and Authorization-Implementing authentication and authorization in Node.js applications, Using popular authentication frameworks like Passport or JWT,Implementing authentication strategies like OAuth or OAuth2,Securing routes and resources in Node.js applications.

Practice:

1. Create a RESTful API that returns a list of movies.
2. Create a schema for movie data and interact with the database.
3. Create a login and registration page for users to access the app.

UNIT – III

Advance Node.js Concepts: Real time Applications with Socket.io, Introduction to Socket.io, a popular library for real-time communication, Building real-time applications like chat applications using Socket.io,Error handling with callbacks (e.g. try/catch),Implementing bi-directional communication between server and clients, Handling events and managing connections in real-time applications

Testing and Debugging in Node.js-Writing unit tests for Node.js applications using frameworks like Mocha or Jest, Using debuggers and logging for troubleshooting in Node.js,Applying best practices for error handling and debugging in Node.js applications

Deployment and Performance Optimization-Deploying Node.js applications to production environments, Optimizing performance and scalability of Node.js applications, Using performance monitoring tools and techniques for Node.js applications, Implementing caching, load balancing, and other performance optimization strategies in Node.js applications

Best Practices and Security in Node.js-Following best practices for writing clean and maintainable Node.js code, Understanding security vulnerabilities and best practices in Node.js applications, Implementing security measures like input validation, output encoding, and authentication, Protecting against common security threats like cross-site scripting (XSS) or cross-site request forgery (CSRF).

Practice:

1. Create a real-time chat application in the movie app.
2. Write unit tests for the movie app.
3. Deploy the movie app to a cloud service like Heroku or AWS.

UNIT – IV

Micro services and Error Handling: Building Micro services with Node.js-Understanding Micro services architecture and its benefits, Building micro services using Node.js and frameworks like Express, Hapi, or Fastify,Implementing communication and coordination between microservices in Node.js,Deploying and managing microservices with Docker and Kubernetes. **Error Monitoring and Logging in Node.js Applications**-Implementing error monitoring and logging with tools like Sentry, Loggly, or ELK stack, Centralized logging and error tracking for Node.js applications, Analyzing and troubleshooting errors in Node.js applications using log data, Best practices for error monitoring and logging in Node.js applications

Continuous Integration and Deployment (CI/CD) in Node.js-Understanding the importance of CI/CD in modern software development, Setting up automated build and deployment pipelines for Node.js applications, Configuring popular CI/CD tools (e.g.,

Jenkins, Travis CI, CircleCI) for Node.js projects, Best practices for continuous integration, automated testing, and deployment in Node.js applications.

Practice:

1. Implement security measures like input validation, output encoding, and authentication.
2. Building a Microservices Architecture with Node.js.
3. Implementing Error Monitoring and Logging in a Node.js Application.

UNIT – V

Basics of Node.js Server Integration: Building Scalable APIs with GraphQL and Node.js,Advanced GraphQL concepts like subscriptions, directives, and fragments, Building high-performance APIs with GraphQL and Node.js,Implementing pagination, batching, and caching in GraphQL APIs,Securing and testing GraphQL APIs in Node.js applications

Serverless Computing with Node.js-Introduction to serverless computing and its advantages, Building server less applications with Node.js using serverless frameworks like AWS Lambda, Azure Functions, or Google Cloud Functions, Implementing serverless event-driven architectures with Node.js,Serverless deployment and monitoring best practices with Node.js.

Practice:

1. Implementing CI/CD for a Node.js Application.
2. Creating Angular Components for Movie App.
3. Creating Movie Search Form.

Text Books:

1. Node.js Design Patterns by Mario Casciaro and Luciano Mammino,2nd Edition, Packet Publishing, ISBN-13: 978-1801077447 .
2. Hands-On Microservices with Node.js by Diogo Resende, 1st Edition, Packet Publishing, ISBN-13: 978-1801070806 .

Reference Books:

1. Node.js in Action by Mike Cantelon, Marc Harter, T.J. Holowaychuk, and Nathan Rajlich, 2nd Edition, Manning Publications, ISBN-13**:** 978-1617294579. .
2. Mastering Node.js by Sandro Pasquali,1st Edition, Packt Publishing, ISBN-13: 978-1782165238 .
3. Express.js Guide: The Comprehensive Book on Express.js by Azat Mardan, 1st Edition, Azat Mardan, ISBN-13**:** 978-1505778282.

Web Links:

1. https://www.upwork.com/resources/server-side-scripting-back-end-web-development-technology
2. https://developer.mozilla.org/en-US/docs/Learn/Server-side/First_steps/Introduction

CLOUD ESSENTIALS

Course Code: 243MC040	L	T	P	C
	2	0	1	3

Course Outcomes:

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

CO1: Explain the fundamentals of Cloud Storage, Cloud Architecture, and Cloud Computing.

CO2: Explain Cloud Computing technologies concerning platforms, services, networks, security, and applications.

CO3: Build Cloud platforms using Google, Amazon, and Microsoft services.

CO4: Examine Cloud services and applications using Webmail, Media, and Streaming.

CO5: Experiment with Cloud-based solutions for individuals and enterprises using Google and Microsoft cloud offerings.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	2	2
CO4	-	3	3
CO5	2	2	3

UNIT – I

Cloud Computing Fundamentals: Introduction to Cloud Computing – I, History of cloud computing, Defining clouds, Cloud providers

Introduction to Cloud Computing II-Consuming cloud services, Cloud architecture, Cloud storage. **Why Cloud Computing?**-Why cloud computing matters, Advantages and disadvantages of cloud computing.

Practice:

1. Configure and manage cloud infrastructure using a popular cloud provider such as Amazon Web Services (AWS), Microsoft Azure, or Google Cloud Platform.
2. Learn to deploy and configure cloud services such as virtual machines, databases, and Web applications using a cloud provider such as AWS or Microsoft Azure to create a Scalable and efficient cloud infrastructure.
3. Analyze the benefits of cloud computing, using real-life examples such as the adoption of cloud computing by Netflix and Uber.

UNIT – II

Cloud Types and Models: Types of Cloud, Types of Cloud, Architecture of Cloud, Cloud services. **Cloud Models**-Iaas, Paas, SaaS.

Practice:

1. Use real-life examples such as the use of public cloud by Airbnb and private cloud by Walmart, students will learn about the different types of cloud environments including Public, private, and hybrid.
2. Use real-life use cases such as the adoption of SaaS by Salesforce and PaaS by Google App Engine, students will learn about the different cloud models including IaaS, PaaS, and SaaS.
3. Learn to use technical interfaces such as APIs and SDKs to interact with cloud Services. Use a cloud provider such as AWS or Google Cloud Platform to develop and deploy applications.

UNIT – III

Inside the Cloud: Inside the Cloud-Administering cloud services, Technical interface, Cloud services

Web-based Application-Web-based Application, Pros and cons of cloud service development.

Hardware and Infrastructure: Clients, Security, Network, Services.

Practice:

1. Using a real-life use case such as the development of web-based applications by Instagram, students will learn to deploy and configure web-based applications in a Cloud environment.
2. This lab will focus on the hardware and infrastructure required to support cloud Computing, using real-life examples such as the use of containerization by Docker and Kubernetes. Students will learn to deploy and manage hardware and infrastructure in a Cloud environment.
3. Using a real-life use case such as the integration of web APIs by Uber, students will Learn to use web APIs to integrate cloud services and develop applications.

UNIT – IV

Accessing Cloud and Managing Data: Accessing the Cloud, Platforms, Web applications, Web API, Cloud storage.

Managing Data on Clouds-"Nature of cloud, Traditional data center, Cost of cloud data center", scaling computer systems, Cloud workload, public, private and hybrid clouds.

Practice:

1. Using real-life examples such as the use of cloud storage by Drop box and the use of Cloud databases by Airbnb, students will learn to manage data on the cloud including Storage, backup, and recovery. They will use a cloud provider such as AWS or Microsoft Azure to configure and manage data on the cloud.
2. Learn the fundamentals of Service-Oriented Architecture (SOA) and its principles. Develop and deploy web services using popular tools such as Apache Axis2 or Apache CXF, and integrate them into a service-oriented architecture.
3. Learn to configure and manage cloud-based storage solutions such as Amazon S3, Microsoft Azure Blob Storage, or Google Cloud Storage. Use these cloud services to store, backup, and recover data in a cloud environment

UNIT – V

Using Cloud: Using Cloud Platforms – I, Understanding service-oriented architecture, Moving applications to the cloud

Using Cloud Platforms II-Working with cloud-based storage, working with productive software

Cloud Elements: Infrastructure as a service, Platform as a service, Software as a service
Thin Clients-Google app engine, Microsoft Windows Azure
Migration-Virtualizing your organization, Server solutions.
Practice:

1. Deploy a web application on a PaaS provider like Heroku or Google App Engine
2. Deploy and configure thin client devices using a cloud provider such as AWS WorkSpaces or Citrix Virtual Apps and Desktops. Learn how to manage user access, performance, and Data security in a thin client environment.
3. Use popular migration tools such as AWS Migration Hub or Microsoft Azure Migrate to Migrate on-premises applications and data to the cloud.

Text Books:

1. Anthony Velte, Toby Velte, and Robert Elsenpeter, "Cloud Computing – A Practical Approach", 1st Edition, McGraw Hill, ISBN-13: 978-0071626949 .
2. Rajkumar Buyya and Vecchiola, Selvi, "Mastering Cloud Computing", 1st Edition, McGraw Hil Education , ISBN-13: 978-0073376229 .

Reference Books:

1. Barrie Sosinsky, "Cloud Computing Bible", 1st Edition, John Wiley & Sons**,** ISBN-13: 978-0470903568.
2. Massimo Cafaro and Giovanni Aloisio, "Grids, Clouds and Virtualization", 1st Edition Springer**,** ISBN-13: 978-3642177556.
3. RajkumarBuyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", 1st Edition ,Wiley Publications**,** ISBN-13: 978-0470887990 .

Web Links:

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. https://www.shiksha.com/online-courses/cloud-computing-basics-by-nptel-course-nptel25

CLOUD ARCHITECTURE, SERVICES AND STORAGE

Course Code: 243MC041	L	T	P	C
	2	0	1	3

Course Outcomes:

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

CO1: Develop an understanding of cloud infrastructure and storage fundamentals, including virtualization, deployment models and service models.

CO2: Develop knowledge of cloud services, including platform and middleware, software, and applications, as well as cloud management and security.

CO3: Gain familiarity with different cloud storage options and their benefits, including encryption, backup, and recovery.

CO4: Analyze the potential advantages and challenges of adopting cloud computing and storage for businesses and organizations.

CO5: Design and implement cloud solutions using platform and middleware services, software, and applications.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	1
CO3	-	3	2
CO4	-	3	3
CO5	2	2	3

UNIT – I

Cloud Computing and Architecture: Introduction to Cloud Computing, Definition of cloud computing, Benefits and drawbacks of cloud computing, Evolution of cloud computing. **Cloud Architecture**-Overview of cloud architecture, Types of cloud services (SaaS, PaaS, IaaS) Virtualization and containerization.

Practice:

1. Research and present the history and evolution of cloud computing, starting from the Early days of mainframe computing to modern cloud technologies.
2. Design and implement a cloud architecture for a hypothetical company, including Computing, storage, networking, and security components.
3. Create and deploy applications using each of the three main cloud service models (IaaS, PaaS, SaaS), comparing and contrasting their strengths and limitations.

UNIT – II

Cloud Service and Deployment Models: Cloud Service Models, Explanation of Infrastructure as a Service (IaaS),Explanation of Platform as a Service (PaaS),Explanation of Software as a Service (SaaS),Comparison of IaaS, PaaS, and SaaS

Cloud Deployment Models-Overview of cloud deployment models, Advantages and disadvantages of each model, Hybrid cloud solutions.

Practice:

1. Deploy and manage cloud resources using the four main cloud deployment models (Public, private, hybrid, multi-cloud), evaluating the pros and cons of each.
2. Compare and contrast the offerings and pricing of different cloud providers, and Develop a strategy for avoiding vendor lock-in when using cloud services.
3. Practice securing cloud resources and services using techniques like encryption, access Controls, and network segmentation, based on real-life use cases of cloud security Breaches.

UNIT – III

Cloud Providers, Security and Networki: Cloud Providers and Vendor Lock-In, Overview of cloud providers, Pros and cons of using a single vendor, avoiding vendor lock-in

Cloud Security-Importance of cloud security, Cloud security challenges, Best practices for securing cloud infrastructure

Cloud Networking-Overview of cloud networking, Virtual Private Cloud (VPC), Network Address Translation (NAT)

Practice:

1. Learn how to design and configure cloud networks, including virtual private clouds, Subnets, and load balancers, using real-life examples of cloud networking challenges and solutions.
2. Experiment with different cloud storage services and learn how to manage data in the Cloud, including backup, replication, and archiving, based on real-life use cases of Cloud storage.
3. Compare and contrast different cloud storage services like Amazon S3, Google Cloud Storage, and Azure Blob Storage, and learn how to use them for specific use cases like bject storage, block storage, and file storage.

UNIT – IV

Cloud Storage and Services: Cloud Storage,Overview of cloud storage,Types of cloud storage (Object, Block, File),Amazon S3 and other popular cloud storage services

Cloud Storage Services-Overview of cloud storage services, Database as a Service (DBaaS), Backup as a Service (BaaS), Archive as a Service (AaaS)

Practice:

1. Calculate the costs and benefits of using cloud computing versus on-premise Infrastructure for a hypothetical workload, using real-life cost models and business Case examples.
2. Learn how to ensure cloud resources and services comply with industry regulations and Organizational policies, using real-life examples of cloud governance and compliance Challenges.
3. Practice migrating a legacy application to the cloud, including assessing readiness, Choosing the right migration approach, and managing the migration process, based on Real-life migration projects.

UNIT – V

More on Cloud Computing: Cloud Computing Economics, Overview of cloud economics, Pay-as-you-go pricing model, Cost analysis and optimization

Cloud Governance and Compliance-Overview of cloud governance, Compliance and regulatory considerations, Data privacy and security laws

Cloud Migration-Importance of cloud migration, Strategies for cloud migration, Tools and techniques for cloud migration
Cloud Performance and Monitoring-Overview of cloud performance, Monitoring and logging tools, Performance optimization techniques
Cloud Scalability and Availability-Overview of cloud scalability, Techniques for scaling cloud infrastructure, High availability and disaster recovery in the cloud
Future of Cloud Computing-Emerging trends in cloud computing, New technologies and services, Future prospects for cloud computing.
Practice:

1. Learn how to monitor and optimize the performance of cloud resources and services, Including identifying bottlenecks, configuring monitoring tools, and implementing Automated scaling, using real-life use cases of cloud performance issues.
2. Design and configure cloud resources and services for high scalability and availability, Including strategies like auto-scaling, multi-region deployment, and ault-tolerant Architectures, based on real-life examples of cloud scalability and availability Challenges.
3. Research and present emerging cloud technologies and trends, including server less Computing, edge computing, and hybrid cloud, and explore how they might impact the Future of cloud computing.

Text Books:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg, and Andrzej Goscinski - Wiley-IEEE Press. 1st Edition. ISBN-13: 978-0470887995.
2. Cloud Native Architectures: Design high-availability and cost-effective applications for the cloud by Tom Laszewski and Kamal Arora - O'Reilly Media 1st edition. ISBN-13: 978-1492056244.

Reference Books:

1. Cloud Computing: A Practical Approach by Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter - McGraw-Hill Education, 1st edition. ISBN-13: 978-0071626958.
2. Cloud Architecture Patterns: Using Microsoft Azure by Bill Wilder - Microsoft Press, 1st Edition. ISBN-13:978-0735684186.
3. Cloud Computing for Science and Engineering by Ian Foster and Dennis B. Gannon - MIT Press, 1st edition. ISBN-13:978-0262036120.
4. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, and Zaigham Mahmood - Prentice Hall, 1st Edition, ISBN-13:978-0133387520.

Web Links:

1. https://www.geeksforgeeks.org/architecture-of-cloud-computing/
2. https://corporatefinanceinstitute.com/resources/data-science/cloud-services/

CLOUD AND DEVOPS

Course Code: 243MC042	L	T	P	C
	2	0	1	3

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

CO1: Explain the principles of DevOps and its importance in modern software development.

CO2: Identify and analyze different DevOps tools and frameworks for continuous integration, delivery, and deployment.

CO3: Apply infrastructure as code and configuration management using appropriate tools and best practices.

CO4: Design and implement a DevOps pipeline for cloud-native applications or big data projects.

CO5: Demonstrate effective communication and collaboration skills required for building a DevOps culture and team.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2	PSO3
CO1	1	-	-
CO2	2	1	2
CO3	3	-	1
CO4	2	2	3
CO5	-	3	2

UNIT – I

DevOps Fundamentals: Introduction to DevOps, Definition and History of DevOps, Importance of DevOps, Key Principles of DevOps, Agile Development Methodology Overview, Scrum and Kanban Frameworks. **Agile Development Methodology** -Agile Methodology Overview .Scrum vs. Kanban ,Agile vs. Waterfall ,CI Tools and Frameworks

Continuous Delivery (CD)-Continuous Delivery (CD) Definition and Benefits ,CD Pipeline Components ,CD Tools and Frameworks

Continuous Deployment (CD)-Continuous Deployment (CD) Definition and Benefits, CD vs. Continuous Deployment ,CD Pipeline Components

Continuous Integration (CI) -Continuous Integration (CI) Definition and Benefits, IaC Tools and Frameworks ,IaC Best Practices ,Wrap-up and Review

Infrastructure as Code (IaC) -Infrastructure as Code (IaC) Definition and Benefits,IaC Tools and Frameworks,IaC Best Practices

Practice :

1. Introduction to DevOps and Agile Methodology:Set up a small Agile project using Scrum or Kanban frameworks. Track the progress and discuss the differences between Agile and Waterfall methodologies.
2. Continuous Integration (CI):Implement a CI pipeline using Jenkins. Create a simple project, configure Jenkins to run automated tests, and generate reports
3. Continuous Delivery (CD):Create a CD pipeline using tools like GitLab CI or CircleI. Deploy a web application to a staging environment automatically after passing CI tests.

UNIT – II

DevOps Tools: Introduction to Configuration Management, Definition and benefits of configuration management, Configuration management tools and frameworks overview, Configuration management best practices

Git Essentials-Introduction to Git, Basic Git commands and workflows, it branching and merging strategies

Jenkins Fundamentals-Introduction to Jenkins, Overview of Jenkins plugins and integrations, Jenkins best practices and common use cases, setting up Jenkins environment

Containerization with Docker -Introduction to Docker, Understanding Docker architecture and components, Docker best practices and security considerations, Docker hands-on demonstration

Orchestration with Kubernetes-Introduction to Kubernetes, Overview of Kubernetes architecture and components, Kubernetes best practices for scalability and resilience, Deploying applications on Kubernetes

Automating with Ansible-Introduction to Ansible, Creating Ansible playbooks and using modules, Ansible best practices for configuration management,Ansible hands-on lab

Practice:

1. Infrastructure as Code (IaC): Write Terraform scripts to provision and manage infrastructure on a cloud Platform (e.g., AWS, Azure, GCP). Demonstrate version control and rollback features.
2. Configuration Management with Ansible: Create and run Ansible playbooks to automate the setup of a Web server (e.g., Apache, Nginx) on multiple virtual machines.
3. Automated Testing with CI: Set up a simple project with a basic test suite (e.g., unit tests). Configure a CI tool like Travis CI or GitHub Actions to automatically run the tests on every commit.

UNIT – III

DevOps Advance Tools: Introduction to Terraform-Overview of DevOps Tools, Introduction to Infrastructure as Code (IaC), Introduction to Terraform, Terraform Providers and Resources

Territory Best Practices-Understanding Infrastructure as Code (IaC) principles,Terraform Configuration Management,Terraform State Management,Terraform Lifecycle Management,Terraform Security Best Practices

Introduction to Configuration Management with Chef-Introduction to Configuration Management, Overview of Chef, Chef Cookbooks and Recipes, Chef Architecture, Chef Infrastructure Setup. **Chef Best Practices**-Understanding Configuration Management Best Practices, Chef Environment Management, Testing Chef Cookbooks, Chef Code Deployment Best Practices, Chef Security Best Practices. Introduction to Puppet, Introduction to Puppet, Puppet Manifests and Modules, Puppet Architecture, Puppet Infrastructure Setup, Puppet Code Deployment

Monitoring, Alerting, Logging, and Analysis-Overview of Monitoring, Alerting, Logging, and Analysis, Importance of Monitoring and Alerting in DevOps,Monitoring Tools and Frameworks, Alerting Tools and Frameworks, Logging Tools and Frameworks, Analysis Tools and Frameworks

Practice:

1. Containerization with Docker: Build and run a Docker container for a simple web application. Explore Docker Compose for managing multi-container applications
2. Orchestration with Kubernetes: Deploy a multi-tier application on a Kubernetes cluster. Implement scaling And load balancing features, and monitor the application's performance.
3. Terraform for IaC: Write advanced Terraform scripts to manage infrastructure as code, including state Management and provisioning of complex cloud resources.

UNIT – IV

DevOps Security and Compliance + Cloud Computing: High Availability and Load Balancing-Overview ofHigh Availability (HA) and Load Balancing, Concepts and Techniques of HA and Load Balancing, A and LoadBalancing Tools and Frameworks, Case Studies: Implementing HA and Load Balancing in DevOps Environments, Best Practices for HA and Load Balancing

DevOps Security and Compliance-Introduction to DevOps Security and Compliance, Understanding Security and Compliance in DevOps Environments-Best Practices for Ensuring Security and Compliance, Tools and Frameworks for Security and Compliance Automation, Case Studies: Implementing Security and Compliance in DevOps Pipe

Cloud Computing Fundamentals-Overview of Cloud Computing, Cloud Service Models (IaaS, PaaS, SaaS) and Deployment Models (Public, Private, Hybrid, Multi-cloud),Key Considerations for Cloud Adoption, Best Practices for Cloud Computing in DevOps,Case Studies: Implementing Cloud Computing in DevOps Workflows

Virtualization in DevOps-Introduction to Virtualization, Types and Benefits of Virtualization (Server, Network, Storage),Virtualization Tools and Frameworks, Integration of Virtualization with DevOps Practices, Best Practices for Virtualization in DevOps Environments

Service-Oriented Architecture (SOA)-Introduction to Service-Oriented Architecture (SOA),Contrasting SOA with Micro services Architecture, Best Practices for Designing and Implementing SOA,Case Studies: Implementing SOA in Enterprise DevOps Environments, Integration of SOA with DevOps Practices and Tools

Practice:

1. Monitoring and Logging: Set up monitoring and alerting for a web application using Prometheus and Grafana. Implement centralized logging with the ELK stack (Elasticsearch, Logstash, Kibana).
2. Configuration Management with Chef: Develop Chef Cookbooks and recipes to automate the Configuration of an application stack. Test and deploy these configurations using Chef Workstation.
3. High Availability and Load Balancing: Configure load balancers (e.g., HAProxy, Nginx) and set up high Availability for a web application using redundant instances and failover techniques.

UNIT – V

Devops Data Analysis: Testing in DevOps-Introduction to Testing in DevOps, Overview of Testing Processes, Types of Testing in DevOps, Testing Frameworks and Tools. Testing Best Practices

DevOps for Mobile Applications-Introduction to DevOps for Mobile Applications, Mobile App Development Lifecycle, Mobile App Testing and Deployment, Mobile App Analytics and Monitoring, Mobile App Security and Compliance

DevOps for Big Data-Introduction to DevOps for Big Data, Big Data Infrastructure and Architecture, Big Data Storage and Processing Technologies, DevOps Tools and Frameworks for Big Data, Big Data Analytics and Visualization

DevOps for Cloud-Native Applications-Introduction to DevOps for Cloud-Native Applications, Cloud-Native Architecture and Design Patterns, Containerization and Orchestration Tools, Cloud-Native DevOps Tools and Frameworks, Best Practices for DevOps in Cloud-Native Application Development

DevOps Culture and Team Dynamics-Introduction to DevOps Culture,
Agile and Lean Principles in DevOps Culture, Building a DevOps Team,DevOps Communication and Collaboration Tools, Best Practices for Creating a DevOps Culture

Future of DevOps-Emerging Trends and Technologies in DevOps,Predictions for the Future of DevOps,Impact of DevOps on Business and IT, Challenges and Opportunities in DevOps,Best Practices for Staying Up-to-Date with DevOps Trends and Developments

Practice:

1. Security and Compliance:Implement security best practices in a CI/CD pipeline. Use tools like SonarQube For static code analysis and Vault for secrets management.
2. Cloud Computing Fundamentals: Deploy a multi-cloud architecture using services from different cloud Providers (AWS, Azure, GCP). Explore cloud service models (IaaS, PaaS, SaaS) in practical scenarios.
3. Virtualization in DevOps: Create and manage virtual machines using a hypervisor (e.g., VMware, Virtual Box). Integrate these VMs into a DevOps workflow for testing and development purposes.

Text Books:

1. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations" by Gene Kim, Jez Humble, Patrick Debois, and John Willis. Published by IT Revolution Press, 1st Edition,ISBN-13: 978-1942788003
2. "DevOps: A Software Architect's Perspective" by Len Bass, Ingo Weber, and Liming Zhu. Published by Addison-Wesley Professional, 1st Edition,ISBN-13**:**978-1942788003.

Reference Books:

1. Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation" by Jez Humble and David Farley. Published by Addison-Wesley Professional, 1st Edition, ISBN-13: 978-0321601919.
2. " Infrastructure as Code: Managing Servers in the Cloud" by Kief Morris. Published by O'Reilly Media, 2nd edition, ISBN-13: 978-1491924358..
3. " Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale" by Jennifer Davis and Katherine Daniels. Published by O'Reilly Media, 1st edition, ISBN-13 978-1491924358

Web Links:

1. https://onlinecourses.nptel.ac.in/noc19_cs64/preview
2. https://elearn.nptel.ac.in/shop/iit-workshops/completed/cicd-devops-automation-and-devsecops-automation/?v=c86ee0d9d7ed

CLOUD ENGINEERING

Course Code: 243MC043

L	T	P	C
2	0	1	3

Course Outcomes:

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

CO1: Explain the benefits and drawbacks of different cloud computing platforms and select the most appropriate platform for a given application.

CO2: Design and deploy applications using containerization technologies such as Docker and container orchestration platforms such as Kubernetes.

CO3: Apply DevOps practices and tools for continuous integration, testing, and deployment of cloud-based applications.

CO4: Design and implement security measures to protect cloud-based applications from potential threats and attacks.

CO5: Develop and implement disaster recovery plans to ensure high availability and data recovery in case of failures.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	2	2	-
CO3	3	1	-
CO4	-	3	2
CO5	-	2	3

UNIT – I

Introduction to Cloud Platforms: Cloud computing platforms, AWS, Azure, GCP.

Containerization-Docker, Kubernetes, StatefulSets.

DevOps practices-CI/CD, Version control, Automated testing,IaC.

Practice:

1. Setting up a Virtual Machine on AWS EC2 Instance.
2. Docker Container Deployment and Management.
3. Implementing Continuous Integration and Deployment with Jenkins.

UNIT – II

Introduction to Cryptography + Threats and Vulnerablities: Web servers and deployment tools, Apache, Nginx, Deployment tools

Security and scalability-Security best practices, Scalability, Permissioned vs permissionless block chains, Encryption. **Serverless computing**-AWS Lambda, Azure Functions, Google Cloud Functions, Event-driven computing, Serverless architecture.

Practice:

1. Deploying a Web Application using Nginx and Deployment Tools.
2. Securing and Scaling a Web Application.
3. Building and Deploying Serverless Functions with AWS Lambda.

UNIT – III

Block chain Interpretability & Tokenomics: Monitoring and logging, Monitoring, Logging, Testing and debugging smart contracts, Google Cloud Monitoring

Performance optimization-Performance tuning, Database optimization, Content Delivery Networks. **Disaster recovery planning**-Backup and recovery strategies, Replication, Failover, Disaster recovery tools

Networking and load balancing-Virtual networks, Subnets, Load balancers, DNS/CDN.

Practice:

1. Monitoring and Logging for a Web Application.
2. Optimizing Sorting Algorithms for Large Data Sets.
3. Disaster Recovery Planning and Testing for IT Systems.

UNIT – IV

Advance concepts of Blockchain: Security in deployment and hosting, Network security, Firewall, Intrusion detection and prevention, Security groups, SSL/TLS

Deployment strategies-Blue-green deployment, Canary deployment, Rolling deployment, A/B testing. **Performance monitoring and profiling**-Performance monitoring tools, Profiling tools, Performance metrics, Performance analysis.

Practice:

1. Networking and Load Balancing for High Availability.
2. Secure Deployment and Hosting for Web Applications.
3. Deploying and Managing a Database Server with MySQL.

UNIT – V

Block chain Use Cases + Tools & Frameworks: Deployment automation, Scripting, Configuration management tools, Continuous deployment, Infrastructure as Code (IaC)

Compliance and governance-Compliance requirements, Auditing, Security policies, Risk management.

Practice:

1. Performance Monitoring and Profiling for Web Applications.
2. Deployment Automation for Web Applications.
3. Compliance and Governance in IT Operations.

Text Books:

1. "Cloud Computing: From Beginning to End" by Ray Jezek and Joe Khoury, 1st Edition, Wiley Publishing, ISBN Number: 978-0470615207
2. "Cloud Computing Principles and Paradigms" by Rajkumar Buyya, James Broberg, and Andrzej Goscinski, 1st Edition, Wiley Publishing, ISBN Number: 978-0470887998

Reference Books:

1. Kubernetes in Action, Marko Luksa, 1st Edition, Manning Publications, ISBN Number**:** 978-1617293726
2. "Docker Deep Dive" by Nigel Poulton, 4th Edition Independently published, ISBN**:** 978-1736049118
3. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim, Jez Humble, Patrick Debois, and John Willi, 1st Edition, Publisher: IT Revolution Press, ISBN: 978-1942788003

Web Links:

1. https://www.coursera.org/in/articles/what-is-a-cloud-engineer

FUNDAMENTALS OF PRODUCT MANAGEMENT

Course Code: 243MC044

L	T	P	C
2	0	1	3

Course Outcomes:

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

CO1: Learn the core principles and processes of product management, market research, competitive analysis, product strategy etc.

CO2: Develop skills and knowledge in product management tools and techniques, including product roadmapping, user persona development, and agile methodologies.

CO3: Analyze market trends, customer needs, and competitive landscapes to identify potential opportunities and threats for new and existing products.

CO4: Apply product management concepts and techniques to real-world scenarios and problems, and develop comprehensive product strategies.

CO5: Learn best practices and ethical considerations in product management and develop product leadership skills that include stakeholder management, collaboration, and career development.

Mapping of Course Outcomes with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	2	3	-	-	-	2	-	1
CO2	3	2	-	3	2	1	-	-
CO3	-	3	2	2	-	-	-	2
CO4	-	-	3	-	-	2	-	3
CO5	-	-	-	-	3	3	3	-

Mapping of Course Outcomes with Program Specific Outcomes:

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	2	-
CO3	-	3	2
CO4	-	2	3
CO5	-	3	2

UNIT – I

Introduction to Product Management: What is Product Management?, Definition and Importance of Product Management, Role of Product Managers in the Company, Product Management vs. Project Management. **Product Life Cycle and Market Research**-Different stages of Product Life Cycle, Importance of Product Life Cycle, Challenges faced by Product Managers in Product Life Cycle.

Practice:

1. Provide students with wire framing and prototyping tools and have them create Prototypes for a product idea. This experiment helps students learn how to visually Communicate product concepts.
2. Assign students to gather requirements for a product from hypothetical stakeholders. This experiment helps students practice eliciting and documenting product requirements.

UNIT – II

Market Research for Product Management: Importance of Market Research, Types of Market Research, Techniques for conducting Market Research.

Competitive Analysis and Product Strategy-Introduction to Competitive Analysis, Types of Competitive Analysis, How to conduct a Competitive Analysis.

Practice:

1. Provide students with examples of technical debt in software products and discuss its Impact. This experiment helps students understand the trade-offs involved in Technical decisions.
2. Divide students into groups and assign them to research and present on either Agile or waterfall development methodologies. This experiment helps students understand the differences between these approaches.

UNIT – III

Product Strategy: Understanding Product Strategy, Developing Product Vision and Mission Statement, Setting Product Goals and Objectives, Group Activity

Product Development and Launch-Introduction to Product Roadmapping, Types of Product Roadmaps, Building a Product Roadmap, Group Activity.

Practice:

1. Have students create a comprehensive plan for launching a new product, including Marketing, sales, and distribution strategies. This experiment helps students understand the complexities of product launches.

UNIT – IV

Minimum Viable Product (MVP) and User Research: Definition and Importance of MVP, How to build an MVP, User Research and Personas, Group Activity.

Marketing, Growth, and Leadership-Introduction to Product Launch, Marketing Channels and Promotion, Digital Marketing, Group Activity.

Practice:

1. Task students with creating a digital marketing campaign for a specific product, including strategies for SEO, SEM, and social media marketing. This experiment helps students apply digital marketing concepts in a practical context.

UNIT – V

Product Growth and Maintenance: Product Metrics and KPIs, Product Analytics, Customer Success Management, Group Activity, Product Leadership, Stakeholder Management, Product Management Tools and Techniques.

Practice:

1. Provide students with data on product metrics and key performance indicators (KPIs) and ask them to analyze and interpret the data to make strategic recommendations. This Experiment helps students understand how to measure product success and Performance.

Text Books:

1. Product Management: A Multi-Disciplinary Perspective, R. Jayakumar, 1st Edition, PHI Learning Pvt. Ltd**.,** ISBN Number**:** 978-9389347609
2. The Lean Product Playbook: How to Innovate with Minimum Viable Products and Rapid Customer Feedback by Dan Olsen, Wiley India Pvt. Ltd, ISBN Number**:** 978-1118960875
3. Product Management in India by Amanjot Malhotra, 1st Edition, Notion Press, 2021, ISBN Number**:** 978-1685236714

Reference Books:

1. Product Management: An Integrated Approach by Gopalakrishnan R & Suresh P, 1st Edition, Vikas Publishing, 2019, ISBN Number: 978-9325984824
2. Cracking the PM Interview: How to Land a Product Manager Job in Technology by Gayle McDowell & Jackie Bavaro, 1st Edition, Publication- CareerCup, ISBN Number: 978-0984782807.
3. The Art of Product Management: Lessons from a Silicon Valley Innovator by Rich Mironov, BookBaby Publisher in 2020, ISBN Number: 978-1642011167
4. Product Leadership: How Top Product Managers Launch Awesome Products and Build Successful Teams, Richard Banfield, Martin Eriksson, and Nate Walkingshaw, 1st Edition, Publisher: O'Reilly Media, Inc, ISBN Number**:** 978-1491950357

Web Links:

1. https://www.mindtheproduct.com/what-are-the-key-fundamentals-of-product-management/

SOFTWARE QUALITY ASSURANCE

Course Code: 243MC045	L	T	P	C
	2	0	1	3

Course Outcomes:

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

CO1: Evaluate different quality attributes as they relate to a specific software application and design scenarios to test them.

CO2: Draft an outline for an SQAP that outlines quality goals, processes, and resources for a small-scale project.

CO3: Describe one quality standard (e.g., ISO 9001, CMMI) and its relevance to SQA practices.

CO4: Employ error handling or input validation techniques to increase application robustness.

CO5: Analyze quality data and propose solutions for improvement (e.g., enhanced code review processes, and additional testing).

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	2	3	-
CO3	-	-	3
CO4	-	2	-
CO5	3	-	1

UNIT – I

Software Quality Assurance Framework and Standards: Software Quality Attributes, Software Quality Assurance, Components of Software Quality Assurance, Software Quality Assurance Plan, Quality Standards: ISO 9000 and Companion ISO Standards, CMM, CMMI, PCMM, Malcom.

Practice:

1. Evaluating Software Quality Attributes, Select a simple application (e.g., Calculator)., Identify key quality attributes (KQAs) relevant to the application (e.g., Reliability, usability, performance).,Design scenarios to test each KQA.,Analyze results and document how the application meets or fails to meet KQAs.
2. Building a Software Quality Assurance Plan (SQAP), Choose a small-scale project With defined requirements. Develop an SQAP outlining quality goals, processes, and resources., Include sections on defect prevention, testing strategies, reporting, and risk Management.
3. Demystifying Quality Standards (ISO, CMMI, etc.), Research a specific quality Standard (e.g., ISO 9001, CMMI)., Identify key principles and how they relate to SQA Practices. Compare and contrast different standards, highlighting strengths and Weaknesses.

UNIT – II

Quality Assurance: Quality Assurance as dealing with defects, Defects Prevention Techniques, Defect reduction: Inspection –Direct fault detection and removal, testing., Defect Containment: Software fault tolerance and safety assurance and failure containment

Practice:

1. Defect Prevention Techniques in Action, Simulate code development for a smallFunction (e.g., string manipulation)., Apply defect prevention techniques like code Reviews, pair programming, and static analysis tools. Track the number and types of defects identified at each stage.
2. Defect Containment Techniques in Practice, Design a test suite for the simulated code from Experiment 2.1, Implement fault tolerance mechanisms (e.g., error handling, input validation).,Simulate failure scenarios and evaluate containment effectiveness.

UNIT – III

Software Quality Assurance Metrics and Measurement: Software Quality Metrics, Product Quality metrics. Software Quality metrics methodology, Establish quality requirements, Identify Software quality metrics., Implement the software quality metrics, analyze software metrics results, and validate the software quality metrics.

Practice:

1. Defining and Measuring Software Quality Metrics, Select a real-world or simulated software project. Identify relevant product and process quality metrics (e.g., code Coverage, defect density, complexity measures).,Collect data during the development process and analyze trends., Use these metrics to assess project health and make Informed decisions.
2. Exploring Functional vs. Structural Testing, Develop test cases for a simple function (e.g., login functionality) based on requirements. Implement both functional (black box) and structural (white-box) testing approaches., Compare the effectiveness of each technique in uncovering defects.

UNIT – IV

Software Testing: Functional vs, Structural testing, Test planning and preparation, Test executions, Result Checking and Measurement, Test Automation., Testing techniques: Adaptation, specialization, and Integration, Case Study: Hierarchical web Testing. ,Process Improvement: Process Classification, Process Measurement, Process Analysis, and Modelling

Practice:

1. Building, Executing, and Evaluating Test Plans, Design a test plan for a real-world application or a simulated scenario. Specify test objectives, scope, resources, and testing levels (unit, integration, system)., Execute the test plan and record results., Analyze results, identify defect types, and suggest improvements to the test plan.
2. Introduction to Test Automation, Choose a repetitive testing task (e.g., regression testing for a core module)., Learn and experiment with a basic test automation tool (e.g., Selenium).,Record scripts for the chosen task and evaluate the benefits of Automation in terms of efficiency and accuracy.

UNIT – V

Quantifiable Quality Improvement: QA monitoring and measurement, Analysis, and follow-up actions, Implementations, Integration, and tool support. and product-specific

models., Risk Identification for quantifiable quality improvement: Traditional, statistical analysis techniques., New techniques for risk identification.

Practice:

1. Monitoring QA Metrics and Taking Corrective Actions, Monitor software quality metrics throughout a development cycle (e.g., code coverage, defect density).,Use control charts or other statistical tools to identify trends and outliers., Propose corrective actions based on the data analysis (e.g., additional code reviews, targeted testing).
2. Risk Identification for Quality Improvement, Conduct a brainstorming session to identify potential risks related to software quality within a project (e.g., schedule slippage, requirement changes).,Analyze risks using a risk matrix (likelihood vs. impact) and prioritize mitigation efforts.

Text Books:

1. Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, Jeff Tian, 1st Edition, Wiley India Pvt. Ltd, ISBN Number**:** 978-8126511667
2. Software Testing and Quality Assurance by Dr. Rajiv Chopra; 1st Edition , Publication by S.K. Kataria & Sons, ISBN Number: 978-8188453358

Reference Books:

1. Software Engineering: A Practitioner Approach by Roger Pressman, Roger S. Pressman and Bruce R. Maxim, 10th Edition, Tata McGraw-Hill (TMH), ISBN Number: 978-1259029988
2. Software Quality Assurance: From Theory to Implementation by Daniel Galin, 1st edition Pearson India, ISBN Number: 978-8131709382
3. Software Reliability Engineering by John D. Musa, 1st Edition TMH Pub**,** ISBN**:** 978-0070582261
4. Software Quality: State of the Art in Management, Testing, and Tools, Martin Wieczorek and Dirk Meyerhoff, 1st Edition, Publisher: Springer, ISBN Number: 978-3662495816

Web Links:

1. https://www.geeksforgeeks.org/software-engineering-software-quality-assurance/
2. https://www.softwaretestinghelp.com/software-quality-assurance/

SOFTWARE ARCHITECTURE

Course Code: 243MC046	L	T	P	C
	2	0	1	3

Course Outcomes:

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

CO1: Demonstrate proficiency in software architecture fundamentals
CO2: Design high-quality software architecture
CO3: Apply software quality assurance practices
CO4: Utilize formal models and tools for architecture design
CO5: Evaluate software quality metrics and testing strategies

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	3	2	-
CO3	-	3	1
CO4	-	-	3
CO5	-	-	2

UNIT – I

Software Architecture Fundamentals and Designing: Software Architecture Terms, Components, Relationships, Views, Architectural Styles, Types of IT Architectur,Frameworks, Patterns, Methodologies, Processes, Functional and Non-functional Properties. **Overview of Software Architecture**-Understanding the importance of quality architecture, Introduction to architectural styles and trends, Exploring frameworks and patterns in software architecture. **Quality Architecture**-Factors contributing to quality architecture, Architectural lifestyle and its significance

Service-Oriented Architecture (SOA)-Principles of SOA,Service-Oriented Analysis and Design (SOAD),Trends and Enterprise-Wide SOA,Application of SOA in real-world scenarios.

Practice:

1. Designing a simple software architecture: Students could design the architecture for a basic software system, focusing on components, connectors, and their interactions.
2. Implementing different architectural styles: Students could implement simple applications using various architectural styles such as client-server, peer-to-peer, and layered architectures.
3. Conducting architectural reviews: Students could peer review software architecture designs, focusing on identifying potential risks and suggesting improvements.

UNIT – II

Architectural Styles and Formal Models: Introduction to Architectural Styles, Pipes and Filters, Data Abstraction, Object-Orientation, Event-Based, Implicit Invocation, Layered

Systems, Repositories, Interpreters, Process Control, Heterogeneous Architectures
Formalizing Software Architecture-Formalizing a specific system architecture, Formalizing architectural styles and design space, Requirements for Architecture Description Languages, Tools for architectural design: Universal connector language, automated support.
Practice:

1. Analyzing software quality standards: Students could analyze and compare different software quality standards such as ISO 9001 or CMMI, assessing their impact on development processes and outcomes.
2. Implementing defect prevention techniques: Students could implement defect prevention techniques such as code reviews, static analysis, and unit testing to reduce the number and severity of defects.
3. Experimenting with fault tolerance mechanisms: Students could experiment with fault tolerance mechanisms such as redundancy, replication, and diversity to improve system reliability.

UNIT – III
Software Quality Framework and Standards: Concept of Software Quality, Understanding software quality attributes and their significance.
Software Quality Assurance (SQA)-Components of SQA: Planning, implementation, assessment, and improvement., Steps to Develop a SQA Plan: Defining objectives, establishing processes, implementing procedures, and continuous improvement.
Quality Standards-ISO 9000 and Companion ISO Standards,CMM, CMMI, PCMM,Malcolm Baldrige, 3 Sigma, 6 Sigma.
Practice:

1. Analyzing software quality metrics: Students could analyze software quality metrics such as defect density, code coverage, and cyclomatic complexity to measure software quality and identify areas for improvement.
2. Conducting root cause analysis: Students could conduct root cause analysis of software defects to identify underlying process or design issues contributing to the defects.
3. Implementing continuous integration and delivery: Students could set up and configure continuous integration and delivery pipelines to automate the software build, test, and deployment process.

UNIT – IV
Defect Prevention and Containment: Quality Assurance Strategies, Defects Prevention Techniques: Education & training, formal methods., Defect Reduction: Inspection, testing.
Defect Containment-Software Fault Tolerance and Safety Assurance: Implementing mechanisms to contain failures and ensure system reliability.
Practice:

1. Experimenting with different testing methodologies: Students could experiment with different testing methodologies such as black-box testing, white-box testing, and exploratory testing to assess their effectiveness in identifying defects.
2. Analyzing the impact of software quality assurance on customer satisfaction: Students could analyze the relationship between software quality assurance activities and customer satisfaction, using surveys or feedback mechanisms to gather data.
3. Implementing software fault injection testing: Students could simulate and analyze the impact of software faults on system behavior using fault injection techniques.

UNIT – V

Software Quality Assurance Metrics, Measurement, and Testing: Software Quality Metrics, Product Quality Metrics, Process Quality Metrics, Metrics for Software Maintenance **Metrics Methodology**-Establishing quality requirements, Identifying software quality metrics, Implementing and analyzing software metrics results, Software quality indicators, Fundamentals in Measurement theory

Software Testing-Functional vs. Structural Testing, Test Planning and Preparation, Test Execution and Result Checking, Test Automation.

Practice:

1. Conducting failure mode and effects analysis (FMEA): Students could conduct FMEA to identify potential failure modes and their impact on system reliability, using this Analysis to improve system design and implementation.
2. Experimenting with architectural patterns for security: Students could experiment with architectural patterns for security such as zero-trust architecture or defense-in-depth, evaluating their effectiveness in mitigating security threats.
3. Analyzing the impact of software defects and failures on user experience: Students could analyze the impact of software defects and failures on user experience, using metrics such as user satisfaction scores or user retention rates.

Text Books:

1. Service Oriented Architecture (SOA): A Practical Guide for Understanding and Implementing Service-Oriented Architecture , Shankar Kambhampaty , 2nd Edition , Wiley India Pvt. Ltd, ISBN-10**:** 8126528838 , ISBN-13: 978-8126528834
2. Pattern-Oriented Software Architecture, Volume 1: A System of Patterns, Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, 1st Edition, Wiley India Pvt. Ltd, ISBN-10: 9814126730, ISBN-13: 978-9814126734

Reference Books:

1. Software Architecture in Practice, : Len Bass, Paul Clements, Rick Kazman, 3rd Edition, Pearson Edu, ISBN-10: 9332518668, ISBN-13: 978-9332518667
2. Practical Software Testing: A Process-Oriented Approach, Ilene Burnstein, Springer International Edition, Publication**:** Springer, ISBN-10: 8181280734
3. Software Testing in the Real World: Improving the Process, Edward Kit, 1st Edition, Pearson Education, ISBN-10: 817758355X, ISBN-13**:** 978-8177583551

Web Links:

1. https://sarrahpitaliya.medium.com/understanding-software-architecture-a-complete-guide-cb8f0590060
2. https://www.tutorialspoint.com/software_architecture_design/introduction.htm

SOFTWARE VERIFICATION, VALIDATION AND TESTING

Course Code: 243MC047

L	T	P	C
2	0	1	3

Course Outcomes:

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

- **CO1:** Demonstrate understanding of software testing fundamentals and principles.
- **CO2:** Apply diverse testing approaches and techniques for effective software testing.
- **CO3:** Analyze software reliability models and develop testing management strategies.
- **CO4:** Conduct various types of software testing, considering usability, scalability, and security.
- **CO5:** Utilize system testing methodologies and tools for comprehensive software evaluation.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/ PSO	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	-	1	2
CO3	-	3	-
CO4	-	-	3
CO5	1	2	-

UNIT – I

Software Testing Fundamentals: Software Testing Fundamentals, Testing Objectives, Test Cases, General Principles of Testing.

Agile Methodology Impact-Verification and Validation, Failure, Error, Fault, Defect Analysis

Testing Lifecycles-Human Error in Testing, Testing and Debugging, Test Metrics.

Practice:

1. Unit Testing with Mock Objects: Conduct experiments on unit testing using mock Objects to isolate and test individual components of a software system.
2. Automated Regression Testing: Experiment with automated regression testing tools to Validate that recent code changes haven't introduced new bugs or issues.
3. Validation of Input Data: Perform experiments to validate input data, ensuring that the Software handles various types of input correctly (e.g., boundary values, invalidinputs)

UNIT – II

Testing Approaches and Techniques: Testing Approaches, Static Testing, Dynamic Testing, Black Box Testing **Structured Group Examination-**Equivalence Class Partitioning, Boundary Value Analysis, Cause-Effect Graphing **Advanced Testing Techniques-**Gray Box Testing, Experience-Based Testing, Control Flow and Data Flow Testing.

Practice:

1. Exploratory Testing: Conduct experiments on exploratory testing techniques to uncover hidden defects and issues in the software by simulating real-world usage scenarios.
2. Performance Testing: Experiment with performance testing tools to evaluate the responsiveness, scalability, and stability of the software under different loads and stress Conditions.
3. Security Testing: Perform experiments on security testing methodologies to identify Vulnerabilities and weaknesses in the software's security measures

UNIT – III

Design Concepts and Principles: Software Reliability, Reliability Models, Reliability Measures, Verification and Validation Planning.

Top-Down vs. Bottom-Up Testing-Mutation Testing, Test Planning and Management, Testing Process. **Functional vs. Structured Testing**-Maturity Models.

Practice:

1. Usability Testing: Conduct experiments on usability testing to assess the user Friendliness and intuitiveness of the software interface.
2. Ad Hoc Testing: Experiment with ad hoc testing techniques to perform spontaneous and Unplanned tests on the software to identify defects quickly.
3. Static Analysis: Perform experiments on static code analysis tools to identify potential code Defects, security vulnerabilities, and coding standards violations.

UNIT – IV

Software Testing Techniques & Strategies: Types of Testing, Unit Testing, Integration Testing, System Testing

Acceptance Testing-Alpha & Beta Testing, Installation Testing, Usability Testing

Performance Testing-Load Testing, Stress Testing, Security Testing.

Practice:

1. Mutation Testing: Conduct experiments on mutation testing to evaluate the effectiveness of test suites by introducing artificial faults into the codebase and assessing how well the tests detect them.
2. Integration Testing: Experiment with integration testing techniques to verify the interactions between different modules or components of the software system.
3. Model-Based Testing: Perform experiments on model-based testing approaches to Generate test cases from software models and verify the software behavior against these Models.

UNIT – V

Software Technical Metrics: System Tests, Functionality Tests, Robustness Tests, Interoperability Tests.

Scalability Tests-Documentation Tests, Gorilla Testing, Syntax-Based Testing

Testing Tools-Automation of Test Execution, Requirement Tracker, Test Process and Plans.

Practice:

1. **Fault Injection Testing:** Conduct experiments on fault injection techniques to Intentionally introduce faults into the system and observe how the software handles Them.
2. **Compliance Testing:** Perform experiments on compliance testing to ensure that the Software complies with industry standards, regulations, and specifications.
3. User Acceptance Testing (UAT): Conduct experiments on UAT methodologies to Involve end-users in testing the software to ensure it meets their requirements and Expectations before deployment.

Text Books:

1. Software Testing and Quality Assurance, Naik, Kshirasagar; Tripathy,Priyadarshi, 1st Edition, Wiley India pub, ISBN-10: 8126528836, ISBN-13: 978-8126528834
2. Software Testing, Gopalaswamy Ramesh Limaye, 1st Edition, Tata McGraw-Hill Education (TMH), ISBN-10**:** 0070139903**,** ISBN-13**:** 978-0070139909

Reference Books:

1. Introduction To Software Testing, Paul Ammann, Jeff Offutt, 2nd Edition, Cambridge Univ Press, ISBN-10: 1107172012**,** ISBN-13: 978-1107172012
2. Software testing concepts Tools, : K.V.K.K. Prasad, 1st Edition, Dreamtech press, ISBN-10**:** 8177225324, ISBN-13: 978-8177225321

Web Links:

1. https://onlinecourses.nptel.ac.in/noc22_cs61/preview
2. https://www.geeksforgeeks.org/software-engineering-verification-and-validation

FUNDAMENTAL ENGLISH PROFICIENCY

Course Code: 243EN001	L	T	P	C
	0	0	1	1

Course Outcomes:

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

CO1: Understand the different aspects of the English language proficiency with emphasis on LSRW skills.

CO2: Apply communication skills through various language learning activities.

CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.

CO4: Enable them to learn and apply fundamentals of English grammar concepts for improved language

CO5: Make use of various types of vocabulary in different academic and professional careers

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	3	-	-	-
CO2	-	-	-	-	3	-	-	-
CO3	-	-	-	-	3	-	-	-
CO4	-	-	-	-	3	-	-	-
CO5	-	-	-	-	3	-	-	-

Practice:

UNIT – 1 **Outstanding people A/B/C/D**

Listening Conversation about Jocelyn Bell- Burnell, Podcast: The 30-day challenge, Starting a new job, Conversation about technology

Speaking Discussing inspiring people, Asking and answering questions about challenges, Explaining a process; Checking understanding, Discussing technology.

Reading Articles: Protector of the sea and The woman who reinvented children's TV, Interviews: 30-day challenge, Article: Tech free!

Writing Article Organizing an article

Grammar Review of Tenses, Questions

Vocabulary Character adjectives, trying and succeeding

Pronunciation The letter e; Word stress, Rapid speech

UNIT – 2 **Survival A/B/C/D**

Listening Conversation about a survival situation, Interview: The Tiger, Cooking for a friend, Talking about getting lost

Speaking Telling a survival story, Giving advice; Asking questions, Giving compliments and responding, Discussing the natural environment

Reading Article: Lost at sea, Leaflet: How to survive…an animal attack, Leaflet: Be wise and survive

Writing Guidelines, organizing guidelines in a leaflet

Grammar Narrative tenses, Future time clauses and conditionals

Vocabulary Expressions with get, Animals and the environment

Pronunciation Sound and Spelling: g, Intonation in question tags

UNIT – 3	**Talent A/B/C/D**
Listening	Conversation: learning experiences, Radio Programme: The sports gene, Making wedding plans, Interviews about sport
Speaking	Talking about something you have put a lot of effort into, Discussing sport and ways to improve performance, planning a party, Talking about popular sports
Reading	Text about learning; Learning to learn, Article: Born to be the best; Three articles about athletes, Article: Fitness: Seattle snapshot
Writing	Article describing data
Grammar	Multi-word verbs, Present perfect and present perfect continuous
Vocabulary	Ability and achievement, word connected with sport
Pronunciation	Word stress, sound and spelling consonant sounds

UNIT – 4	**Life Lessons A/B/C/D**
Listening	Interview: Psychology of money; Two monologues: Life-changing events, Two monologues; training for a job, Presenting photos, Three monologues; living in different places
Speaking	Talking about how your life has changes, Discuss experiences of training and rules, Describing photos: Expressing careful disagreement, Discussing living in a different country
Reading	Two texts about life-changing events that helped people become rich, Article: Training for the emergency frontline, Advert for being an international student 'buddy'
Writing	Job application, Giving a positive impression
Grammar	Used to and would
Vocabulary	Cause and result, Talking about difficulty
Pronunciation	Sound and spelling: u

UNIT – 5	**Chance A/B/C/D**
Listening	Monologue: What are your chances?, Conversation: Talking about work, Money problems, News reports: environmental problems
Speaking	Discussing possible future events, Role Play: job interview, Explaining and responding to an idea for a café, Giving opinions on environmental problems
Reading	Quiz: Are you an optimist or a pessimist?; Article: Why we think we're going to have a long and happy life, Quiz: The unknown continent; Article: Cooking in Antarctica, Essay about protecting the environment
Writing	For and against essay, Arguing for and against an idea
Grammar	Future probability, Future perfect and future continuous
Vocabulary	Adjectives describing attitude, The natural world
Pronunciation	Sound and spelling : th, Intonation groups

Suggested Software:

- Cambridge Empower
- Soft X (K-Van Solutions)

Text Book:

1. Cambridge Empower – Second Edition B2 Level - Adrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis – Jones.

Reference Books:

1. M Ashraf Rizvi: Effective Technical Communication
2. Raymond Murphy: English Grammar in Use, Cambridge University Press. Fifth Edition
3. J. Sethi & P.V. Dhamija. A Course in Phonetics and Spoken English, (2nd Ed), Kindle

Web links:

1. www.cambridgeone.org
2. https://www.britishcouncil.in/english/online
3. www.englishmedialab.com

ADVANCED ENGLISH PROFICIENCY

Course Code: 243EN002

L	T	P	C
0	0	1	1

Course Outcomes:

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

- **CO1:** Recognize the basics of communication and summarize formal and informal language expressions in all aspects.
- **CO2:** Establish and maintain interpersonal relationships and transmit the message through different language activities.
- **CO3:** Use language effectively to prepare and demonstrate proficiency in facing various types of interviews.
- **CO4:** Demonstrate and exhibit professionalism in participating in various public speaking activities like debates, group discussions and presentation skills.
- **CO5:** Identify the basic elements of writing and apply the fundamentals to compose e-mails catering to different professional needs.

Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	3	-	-	-
CO2	-	-	-	-	3	-	-	-
CO3	-	-	-	-	3	-	-	-
CO4	-	-	-	-	3	-	-	-
CO5	-	-	-	-	3	-	-	-

List of the Topics

UNIT – I **Around the globe A/B/C/D**

Listening Two monologues about sightseeing tours, Interview: disappearing languages, Asking for a favour, conversation: a trip to the Grand Canyon

Speaking Comparing different tourist destinations, Agreeing and disagreeing, Asking for a favour, Discussing local tourist destinations.

Reading Website bout four tourist destinations; Website: Where to go?

Writing Travel blog, Using descriptive language

Grammar Infinitives and –ing forms

Vocabulary Travel and tourism, Describing changes

Pronunciation Consonant clusters, Consonant sounds

UNIT – II **City living A/B/C/D**

Listening Interview: ‘Smart’ cities: Two monologues talking about ‘smart’ cities, Two monologues: house renovations, Flat hunting, Interviews about a new shopping centre

Speaking Discussing good and bad points about a city

Reading Article: Quick-slow down!, Article: Who puts the ‘real’ in reality TV? Email: Complaining about an important issue.

Writing Email of complaint, Using formal language

Grammar Too/enough; so/such, Causative have/get

Vocabulary Describing life in cities, Film and TV; Houses

Pronunciation Sound and spelling: o, Stress in compound nouns

UNIT – III	**Dilemmas A/B/C/D**
Listening	Radio programme: person finance, Three monologues about honesty, Going to the bank, Conversation about a TV programme
Speaking	Giving opinions on financial matters, Discussing moral dilemmas, Talking about hopes and worries Discussing programmes about crime
Reading	Article: Is it time to give up on cash?, Newspaper article: The honesty experiment, Review: Crime with a smile
Writing	Review, Organising a review
Grammar	First and second conditionals, Third conditional; should have+past participle
Vocabulary	Money and finance, Crime
Pronunciation	Stressed and unstressed words; Sound and spelling: l, Word groups

UNIT – IV	**Discoveries A/B/C/D**
Listening	Conversation about inventions, Conversation about an email hoax, Finding the perfect flat, Four monologues about alternative medicine
Speaking	Talking about inventions, Describing a hoax or a scam or a case of fraud, Giving and receiving surprises
Reading	Article: Too good to be true?, Article: The rise and fall of Barry Minkow, Essay: The Value of alternative medicine
Writing	Opinion essay, Presenting a series of arguments
Grammar	Relative clauses, Reported speech; Reporting verbs
Vocabulary	Health, Verbs describing thought and knowledge
Pronunciation	Sound and spelling : ui, Linking and intrusion

UNIT – V	**Possibilities A/B/C/D**
Listening	Interview about Dan Cooper, Two monologues: pursuing a dream, Celebrating good news, conversation about goals
Speaking	Telling stories about coincidences, Describing and comparing brave or amazing people, Telling an important piece of news, Talking about performing
Reading	Story: The man who disappeared; Blog: The Wreck of the Titan, Article: Dream to help, Story: Rosa's diary: The ultimate goal
Writing	Story, Making a story interesting
Grammar	Past modals of deduction, Wishes and regrets
Vocabulary	Adjectives with prefixes, Verbs of effort
Pronunciation	Word stress, Linking, Consonant clusters

Suggested Software:

- Cambridge Empower
- Soft X (K-Van Solutions)

Text Book:

1. Cambridge Empower – Second Edition B2 Level - Adrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis – Jones.

Reference Books:

1. Raman Meenakshi, Sangeeta-Sharma. Technical Communication. Oxford University Press.
2. Michael Swan- Practical English Usage
3. Taylor Grant: English Conversation Practice, Tata McGraw-Hill Education India.

Web links:

1. https://www.coursera.org/
2. https://www.skillshare.com/
3. https://www.mindtools.com/cawh8bu/communication-tools

DESIGN THINKING

Course Code: 243MC031	L	T	P	C
	0	0	1	1

Course Outcomes:

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

- **CO1:** Appreciate various design process procedure
- **CO2:** Generate and develop design ideas through different technique
- **CO3:** Identify the significance of reverse Engineering to Understand products
- **CO4:** Draw technical drawing for design ideas
- **CO5:** Illustrate design teams to create feasible and user-focused solutions to complex problems in design.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	3	1	1
CO3	1	2	2
CO4	2	-	-
CO5	2	2	2

UNIT – I

Process of Design Understanding Design thinking: Shared model in team-based design – Theory and practice in Design thinking – Explore presentation signers across globe – MVP or Prototyping.

UNIT – II

Tools for Design Thinking: Real-Time design interaction capture and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design

UNIT – III

Design Thinking in IT: Design Thinking to Business Process modelling – Agile in Virtual collaboration environment – Scenario based Prototyping

UNIT – IV

DT For strategic innovations: Growth – Story telling representation – Strategic Foresight - Change – Sense Making - Maintenance Relevance – Value redefinition - Extreme Competition – experience design.

UNIT – V

Design thinking workshop: Design Thinking Work shop Empathize, Design, Ideate, Prototype and Test.

Text Books:

1. , “Engineering Design”- John.R.Karsnitz, Stephen O’Brien and John P. Hutchinson Second Edition, Cengage learning (International edition), ISBN Number: 978-1-305-49650-1
2. "The Design of Business: Why Design Thinking is the Next Competitive Advantage" - Roger Martin, First Edition, Harvard Business Press, ISBN Number: 978-1422138565

Reference Books:

1. “Engineering Design Process” - Yousef Haik and Tamer M.Shahin, Second Edition, Cengage Learning, ISBN Number: 978-1-305-20680-4
2. Solving Problems with Design Thinking - Ten Stories of What Works - Hardcover by Jeanne Liedtka, Andrew King, Kevin Bennett, Columbia Business School Publishing, ISBN Number: 978-0231156366.

Web Links:

1. www.tutor2u.net/business/presentations/
2. www./Product lifecycle/default.html
3. https://docs.oracle.com/cd/E11108_02/otn/pdf /

RESEARCH METHODOLOGY

Course Code: 243AC001

L	T	P	C
2	0	0	0

Course Outcomes:

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

- **CO1:** Understand what research is, why it's done, and its importance in different fields.
- **CO2:** Learn how to clearly define research questions and review existing literature to improve research focus.
- **CO3:** Gain skills in planning research studies and using literature effectively to support research methods.
- **CO4:** Understand how data is collected, measured (quantitative and qualitative), and prepared for analysis in research.
- **CO5:** Develop the ability to interpret research findings, write clear reports, and present research results effectively.

Mapping of Course Outcomes with Program Outcomes:

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

Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO1	PSO2	PSO3
CO1	-	2	2
CO2	-	3	3
CO3	2	2	2
CO4	2	1	1
CO5	1	-	-

UNIT – I

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.

UNIT – II

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

UNIT – III

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Principles of experimental design- Working with Literature: Importance- finding literature- Using your resources- Managing the literature- Keep track of references- Using the literature- Literature review- On-line Searching: Database-SCI Finder- Scopus- Science Direct-Searching research articles- Citation Index - Impact Factor -H-index.

UNIT – IV

Research Data: Measurement of Scaling: Quantitative-Qualitative,-Classification of Measure scales- Data Collection- Data Preparation.

UNIT – V

Report Writing: Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout. Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Text Books:

1. C. R. Kothari, Research Methodology Methods and Techniques, 4th Edition, New Age International Publishers, 2019, ISBN: 978-9386649225
2. The Essential Guide of Doing Research - Zina O'Leary, 3rd Edition, SAGE Publications Ltd, ISBN: 978-1473952072

Reference Books:

1. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, J. W. Creswell, 4th Edition, SAGE Publications, ISBN: 978-1483346355
2. Research Methodology: A Step-by-Step Guide for Beginners, Kumar, 4th Edition, SAGE Publications Ltd, ISBN: 978-1526446715
3. Research Methods: The concise knowledge base - Trochim, Atomic Dog Publishing, ISBN: 978-1592603946
4. Conducting Research Literature Reviews: From the Internet to Paper - Fink A, Edition: 5th Edition, Sage Publications, ISBN: 978-1506350240
5. Research Methodology a step-by- step guide for beginners. (For the topic Reviewing the literature (Unit – II)) Ranjit Kumar, 3rd Edition, SAGE Publications Ltd Study Material, ISBN: 978-1849203228

Web Links:

1. https://paperpal.com/blog/academic-writing-guides/what-is-research-methodology
2. https://gradcoach.com/what-is-research-methodology/
3. https://www.oxbridgeessays.com/blog/different-types-of-research-methodology-in-research/
4. https://onlinecourses.nptel.ac.in/noc24_ge41/preview
5. https://www.euacademic.org/BookUpload/9.pdf

EMPLOYABILITY SKILLS-

Course Code: 243AC002	L	T	P	C
	0	0	3	0

Aptitude:
Number System, LCM & HCF, Ratio and Proportion, Averages

Reasoning:
Number Series, Letter Series, Number Analogy, Letter Analogy, Odd Man Out, Logical Sequence of Words.

Verbal:
Introduction to soft skills, how to improve communication? Parts of Speech, Mind your language towards better English, Vocabulary Expansion

Text Books:

1. Quantitative Aptitude for Competitive Examinations - Dr. R. S. Aggarwal, S. Chand Publishing, ISBN: 978-9352534029
2. A Modern Approach to Verbal and Non-Verbal Reasoning - Dr. R. S. Aggarwal, Publication: S. Chand Publishing, ISBN: 978-9352832163

Reference Books:

1. Quick Learning Objective General English - Dr. R. S. Aggarwal, Vikas Aggarwal, S. Chand Publishing, ISBN: 978-9352837564
2. Quantitative Aptitude for Competitive Examinations, Abhijit Guha, McGraw Hill Education, ISBN: 978-9353160180
3. Analytical Reasoning - M. K. Pandey, Arihant Publications, ISBN: 978-9350947982

Web Links:

1. www.indiabix.com
2. www.bankersadda.com

EMPLOYABILITY SKILLS-

Course Code: 243AC003	L	T	P	C
	0	0	3	0

Aptitude:
Problems on Ages, Partnership, Percentages, Profit and Loss

Reasoning:
Coding and Decoding, Ranking Test, Alphabet Test, Direction Test

Verbal:
Written communication skill practice, Grammatical use, Concept of 4 step method for presentation, Present Tense

Text Books:

1. Quantitative Aptitude for Competitive Examinations - Dr. R. S. Aggarwal, S. Chand Publishing, ISBN: 978-9352534029
2. A Modern Approach to Verbal and Non-Verbal Reasoning - Dr. R. S. Aggarwal, Publication: S. Chand Publishing, ISBN: 978-9352832163

Reference Books:

1. Quick Learning Objective General English - Dr. R. S. Aggarwal, Vikas Aggarwal, S. Chand Publishing, ISBN: 978-9352837564
2. Quantitative Aptitude for Competitive Examinations, Abhijit Guha, McGraw Hill Education, ISBN: 978-9353160180
3. Analytical Reasoning - M. K. Pandey, Arihant Publications, ISBN: 978-9350947982

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1. www.indiabix.com
2. www.bankersadda.com

EMPLOYABILITY SKILLS-

Course Code: 243AC004	L	T	P	C
	0	0	3	0

Aptitude:
Simple Interest, Compound Interest, Time and Work, Pipes and Cisterns

Reasoning:
Blood Relations, Calendar, Clocks, Cubes and Dice, Coded Inequalities

Verbal:
Grammar in use, Group discussion, Reading Comprehension, Past Tense, Future Tense

Text Books:

1. Quantitative Aptitude for Competitive Examinations - Dr. R. S. Aggarwal, S. Chand Publishing, ISBN: 978-9352534029
2. A Modern Approach to Verbal and Non-Verbal Reasoning - Dr. R. S. Aggarwal, Publication: S. Chand Publishing, ISBN: 978-9352832163

Reference Books:

1. Quick Learning Objective General English - Dr. R. S. Aggarwal, Vikas Aggarwal, S. Chand Publishing, ISBN: 978-9352837564
2. Quantitative Aptitude for Competitive Examinations, Abhijit Guha, McGraw Hill Education, ISBN: 978-9353160180
3. Analytical Reasoning - M. K. Pandey, Arihant Publications, ISBN: 978-9350947982

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1. www.indiabix.com
2. www.bankersadda.com