



# New Prince Shri Bhavani College of Engineering and Technology

(An Autonomous Institution)

**CURRICULUM & SYLLABUS**

**(REGULATION 2023)**

**FOR**

**MCA - MASTER OF COMPUTER APPLICATIONS**

**(CHOICE BASED CREDIT SYSTEM)**

**(Applicable to the students admitted from the Academic Year 2023 - 24)**

MASTER OF COMPUTER APPLICATIONS (2 YEARS)

REGULATIONS - 2023

CHOICE BASED CREDIT SYSTEM

NAME OF THE PROGRAMME: M.CA						
Sl. No.	SUBJECT AREA	CREDITS PER SEMESTER				CREDITS TOTAL
		I	II	III	IV	
1.	FC	04	00	00	00	04
2.	PCC	16	19	12.5	00	47.5
3.	PEC	00	03	06	00	09
4.	RMC	02	00	00	00	02
5.	OEC	00	00	03	00	03
6.	EEC	01	1.5	00	12	14.5
7.	VAC	00	00	00	00	00
8.	<b>TOTAL CREDITS</b>	<b>23</b>	<b>23.5</b>	<b>21.5</b>	<b>12</b>	<b>80</b>

*Approved*  
*(Signature)*

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Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
<b>THEORY COURSES</b>								
1	FC	P23MA102	Applied Probability, Statistics and Operations Research	3	1	0	4	4
2	RMC	P23RM102	Research Methodology and IPR	2	0	0	2	2
3	PCC	P23MC101	Advanced Data Structures and Algorithms	3	0	0	3	3
4	PCC	P23MC102	Object Oriented Software Engineering	3	0	0	3	3
5	PCC	P23MC103	Python Programming	3	0	0	3	3
6	PCC	P23MC104	Fundamentals of Accounting	3	0	2	5	4
7	VAC	P23VAXX	*Value Added Courses - I	2	0	0	2	0
<b>PRACTICAL COURSES</b>								
8	PCC	P23MC105	Advanced Data Structures and Algorithms Laboratory	0	0	3	3	1.5
9	PCC	P23MC106	Python Programming Laboratory	0	0	3	3	1.5
10	EEC	P23EN101	Communication Skills Laboratory	0	0	2	2	1
<b>TOTAL CREDITS</b>								<b>23</b>

<b>SEMESTER - II</b>								
Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
<b>THEORY COURSES</b>								
1	PCC	P23MC201	Full Stack Web Development	3	0	0	3	3
2	PCC	P23MC202	Advanced Database Technology	3	0	0	3	3
3	PCC	P23MC203	Cloud Computing Technologies	3	0	0	3	3
4	PCC	P23MC204	Programming with Java	3	0	2	5	4
5	PCC	P23MC205	Big Data Analytics	3	0	0	3	3
6	PEC	P23MCELXX	Professional Elective - I					3
7	VAC	P23VAXX	*Value Added Courses - II	2	0	0	2	0
<b>PRACTICAL COURSES</b>								
8	PCC	P23MC206	Advanced Database Technology Laboratory	0	0	3	3	1.5
9	PCC	P23MC207	Full Stack Web Development Laboratory	0	0	3	3	1.5
10	EEC	P23EEMC201	Software Development Laboratory	0	0	3	3	1.5
<b>TOTAL CREDITS</b>								<b>23.5</b>

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SEMESTER - III								
Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
<b>THEORY COURSES</b>								
1	PCC	P23MC301	Machine Learning	3	0	0	3	3
2	PCC	P23MC302	Mobile Application Development	3	0	2	5	4
3	PCC	P23MC303	Cyber Security	3	0	2	5	4
4	PEC	P23MCELXX	Professional Elective - II					3
5	PEC	P23MCELXX	Professional Elective - III					3
6	OEC	P23OEMCXX	Open Elective					3
<b>PRACTICAL COURSES</b>								
7	PCC	P23MC304	Machine Learning Laboratory	0	0	3	3	1.5
<b>TOTAL CREDITS</b>								<b>21.5</b>

SEMESTER - IV								
Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
<b>THEORY COURSES</b>								
1	EEC	P2EEMC401	Project Work	0	0	24	24	12
<b>TOTAL CREDITS</b>								<b>12</b>

PROFESSIONAL ELECTIVES								
Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
<b>PROFESSIONAL ELECTIVE - I</b>								
1	PEC	P23MCEL01	Software Project Management	3	0	0	3	3
2	PEC	P23MCEL02	Professional Ethics in IT	3	0	0	3	3
3	PEC	P23MCEL03	E - Learning	3	0	0	3	3
4	PEC	P23MCEL04	Security in computing	3	0	0	3	3
5	PEC	P23MCEL05	Information Retrieval Techniques	3	0	0	3	3
6	PEC	P23MCEL06	Soft Computing Techniques	3	0	0	3	3
7	PEC	P23MCEL07	Adhoc and Sensor Network	3	0	0	3	3
8	PEC	P23MCEL08	Business Data Analytics	3	0	0	3	3
<b>PROFESSIONAL ELECTIVE - II</b>								
1	PEC	P23MCEL09	Internet of Things	3	0	0	3	3
2	PEC	P23MCEL10	Digital Image Processing	3	0	0	3	3

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3	PEC	P23MCEL11	Social Network Analytics	3	0	0	3	3
4	PEC	P23MCEL12	Digital Marketing	3	0	0	3	3
5	PEC	P23MCEL13	Advances in Networking	3	0	0	3	3
6	PEC	P23MCEL14	Geological Information Systems	3	0	0	3	3
<b>PROFESSIONAL ELECTIVE - III</b>								
1	PEC	P23MCEL15	Wireless Networking	3	0	0	3	3
2	PEC	P23MCEL16	Block Chain Technologies	3	0	0	3	3
3	PEC	P23MCEL17	Organizational Behavior	3	0	0	3	3
4	PEC	P23MCEL18	Service Oriented Architecture	3	0	0	3	3
5	PEC	P23MCEL19	Human Resource Management	3	0	0	3	3
6	PEC	P23MCEL20	Software Testing and Quality Assurance	3	0	0	3	3

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
<b>OPEN ELECTIVES</b>								
1	OEC	P23OEMC01	Intellectual Property Rights	3	0	0	3	3
2	OEC	P23OEMC02	Machine Learning and Deep Learning	3	0	0	3	3
3	OEC	P23OEMC03	IOT for Smart Systems	3	0	0	3	3
4	OEC	P23OEMC04	Health Care Management	3	0	0	3	3
5	OEC	P23OEMC05	Environmental Sustainability	3	0	0	3	3

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Total Contact Periods	Credits
<b>VALUE ADDED COURSES (VAC)</b>								
1	VAC	P23VA01	Disaster Management	2	0	0	2	0
2	VAC	P23VA02	Essence of Indian Traditional knowledge	2	0	0	2	0
3	VAC	P23VA03	Constitution of India	2	0	0	2	0
4	VAC	P23VA04	நற்றமிழ் இலக்கியம்	2	0	0	2	0

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## BRIDGE COURSES

(For the M.C.A students admitted under non-computer-science background category)  
Classes are to be conducted and completed before the start of the class of first semester;  
Examinations will be conducted along with first semester

Sl. No.	Course Category	CourseCode	Course Title	L	T	P	Total Contact Periods	Credits
1	BC	P23BC01	Data Structures and Algorithms	3	0	2	5	4
2	BC	P23BC02	Programming in C	3	0	2	5	4

Classes are to be conducted and completed before the start of the class of Second semester; Examinations will be conducted along with Second semester

Sl. No.	Course Category	CourseCode	Course Title	L	T	P	Total Contact Periods	Credits
1	BC	P23BC03	Object Oriented Programming	3	0	2	5	4
2	BC	P23BC04	Database Management System	3	0	0	3	3

Classes are to be conducted and completed before the start of the class of Third semester; Examinations will be conducted along with Third semester

Sl. No.	Course Category	CourseCode	Course Title	L	T	P	Total Contact Periods	Credits
1	BC	P23BC05	Introduction to Computer Organization and Operating Systems	3	0	0	3	3
2	BC	P23BC06	Computer Networks	3	0	0	3	3

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**P23MA102 APPLIED PROBABILITY, STATISTICS AND OPERATIONS RESEARCH L T P C**

**Prerequisites: Probability Theory, Statistics, Optimization Theory**

**3 1 0 4**

**COURSE OBJECTIVES:**

- To provide necessary concepts of probability, random variables and standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the concepts of tests of hypothesis and apply in various statistical data.
- To understand different methods involved in linear programming models, transportation and assignment models.

**UNIT I PROBABILITY AND RANDOM VARIABLES 12**

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

**UNIT II TWO DIMENSIONAL RANDOM VARIABLES 12**

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

**UNIT III TESTING OF HYPOTHESIS 12**

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

**UNIT IV LINEAR PROGRAMMING MODELS 12**

Mathematical Formulation - Graphical Solution of linear programming models – Simplex method – Artificial variable Techniques.

**UNIT V TRANSPORTATION AND ASSIGNMENT MODELS 12**

Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution – optimum solution - degeneracy –Mathematical formulation of assignment models – Hungarian Algorithm.

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

- 1 P Sivaramakrishna Das, C Vijayakumari, “Probability and Statistics”, 2<sup>nd</sup> Edition, Pearson Education, 2020.
- 2 Taha H A, “Operations Research: An Introduction”, 11<sup>th</sup> Edition, Pearson Education, 2021.

**REFERENCES:**

- 1 Oliver C. Ibe, “Fundamentals of Applied probability and Random Processes”, Academic Press, 2019.
- 2 Johnson R. A., Gupta C.B., “Miller and Freund’s Probability and Statistics for Engineers”, 9<sup>th</sup> Edition, Pearson Education, 2017.

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3 Panneerselvam R "Operations Research", 3<sup>rd</sup> Edition, Prentice Hall of India, 2023.

**ONLINE RESOURCES:**

- 1 [https://ugcmoocs.inflibnet.ac.in/index.php/courses/view\\_ug/327](https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/327)
- 2 <https://archive.nptel.ac.in/courses/111/106/111106112/>
- 3 <https://archive.nptel.ac.in/courses/110/106/110106062/>

**COURSE OUTCOMES:**

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

- C01** Apply the concepts of probability and random variables in engineering applications.
- C02** Analyze the concepts of two dimensional random variables.
- C03** Apply statistical tests in testing of hypotheses on data.
- C04** Solve linear programming models.
- C05** Apply the concepts of transportation and assignment models in real life applications.

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>C01</b>	3	2	1	2	-	-	-	1	-	-	-	1	-	-
<b>C02</b>	3	3	2	2	-	-	-	1	-	-	-	1	-	-
<b>C03</b>	3	2	1	2	-	-	-	1	-	-	-	1	-	-
<b>C04</b>	3	2	1	2	-	-	-	1	-	-	-	1	-	-
<b>C05</b>	3	2	1	2	-	-	-	1	-	-	-	1	-	-

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**P23RM102**

**RESEARCH METHODOLOGY AND IPR**

**L T P C**

**Prerequisites:** Nil

**2 0 0 2**

**COURSE OBJECTIVES:**

- To gain a comprehensive understanding of various research methods
- To Learn how to formulate research questions, collect data, design research studies, develop hypotheses, and create research plans.
- To explore national and international laws, agreements, and guidelines governing intellectual property rights, and understand their implications for researchers

**UNIT I**

**RESEARCH DESIGN**

**6**

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

**UNIT II**

**DATA COLLECTION AND SOURCES**

**6**

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

**UNIT III**

**DATA ANALYSIS AND REPORTING**

**6**

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

**UNIT IV**

**INTELLECTUAL PROPERTY RIGHTS**

**6**

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

**UNIT V**

**PATENTS**

**6**

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

**TOTAL: 30 PERIODS**

**TEXT BOOKS:**

- 1 C R Kothari, "Research Methodology Methods and Techniques", 4<sup>th</sup> Edition, New Age International Publishers, 2019.
- 2 Mousami V Munot, Vinayak Bairagi, "Research Methodology A Practical and Scientific Approach", CRC Press, 2019.

**REFERENCES:**

- 1 Schindler Pamela S, "Business Research Methods", 14<sup>th</sup> Edition, Tata McGraw Hill, 2022.
- 2 The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice",

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**ONLINE RESOURCES:**

- 1 <https://www.mooc-list.com/tags/research-methodology>
- 2 [https://onlinecourses.nptel.ac.in/noc22\\_ge08/preview](https://onlinecourses.nptel.ac.in/noc22_ge08/preview)
- 3 [https://www.wipo.int/academy/en/courses/distance\\_learning/](https://www.wipo.int/academy/en/courses/distance_learning/)

**COURSE OUTCOMES**

- C01 Describe the research process and design.  
C02 Explain the sources and methods for data collection.  
C03 Describe the various data analysis and reporting.  
C04 Apply the concept of IPR and its development process.  
C05 Summarize the various components of patent and the process of E- filling.

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	-	2	2
C02	2	2	1	1	-	-	-	-	1	-	-	-	2	2
C03	2	2	1	1	-	-	-	-	-	-	-	-	2	2
C04	3	2	1	2	-	-	1	-	-	-	-	-	2	2
C05	2	2	1	1	-	-	-	-	-	-	-	-	2	2

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**P23MC101      ADVANCED DATA STRUCTURES AND ALGORITHMS      L   T   P   C**

**Prerequisites: Data Structures and Analysis of Algorithms      3   0   0   3**

**COURSE OBJECTIVES:**

- To understand the usage of algorithms in computing
- To learn and use hierarchical and non-hierarchical data structures and its operations.
- To study about NP Completeness of problems.

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

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

**UNIT II      HIERARCHICAL DATA STRUCTURES      9**

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

**UNIT III      GRAPHS      9**

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

**UNIT IV      ALGORITHM DESIGN TECHNIQUES      9**

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

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

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

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 S Sridhar, "Design and Analysis of Algorithms", 2<sup>nd</sup> Edition, Oxford University Press, 2023.
- 2 S Chand, "Data Structures", S Chand Publishing, 2024.

**REFERENCES:**

- 1 T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, "Introduction to Algorithms", 4<sup>th</sup> Edition, Prentice Hall of India, 2022.
- 2 Wisnu Anggoro, "C++ Data Structures and Algorithms", 1<sup>st</sup> Edition, Packt Publishing, 2018.

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3 R S Salaria, "Data Structures & Algorithms Using C++", 3<sup>rd</sup> Edition, Khanna Publishers, 2021.

**ONLINE RESOURCES:**

- 1 <https://nptel.ac.in/courses/106102064>
- 2 <https://www.coursera.org/specializations/data-structures-algorithms#courses>
- 3 <https://www.scaler.com/topics/course/cpp-data-structures/>

**COURSE OUTCOMES:**

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

- C01 Explain characteristics, complexity and asymptotic notation of an algorithm..
- C02 Create real time application using various tree structures.
- C03 Design an algorithm based on graph structure to solve problems.
- C04 Analyze various algorithm design techniques in dynamic programming.
- C05 Describe Non-deterministic Polynomial completeness problem.

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	3	3	3	3	-	-	-	1	-	-	-	1	2	2
C03	3	3	3	3	-	-	-	1	-	-	-	1	2	2
C04	3	3	1	2	-	-	-	1	-	-	-	1	2	2
C05	2	2	1	1	-	-	-	1	-	-	-	1	2	2

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**P23MC102**                      **OBJECT ORIENTED SOFTWARE ENGINEERING**                      **L T P C**

**Prerequisites: Object-Oriented Analysis and Design, Software Engineering**    **3 0 0 3**

**COURSE OBJECTIVES:**

- To provide an idea of using various process models according to given circumstances.
- To demonstrate agility in solving software and system challenge.
- To describe data models, object models, context models, design patterns and behavioral models.

**UNIT I                      SOFTWARE DEVELOPMENT AND PROCESS MODELS**                      **9**

Introduction to Software Development – Challenges – An Engineering Perspective – Object Orientation – Software Development Process – Iterative Development Process – Process Models – Life Cycle Models – Unified Process – Iterative and Incremental.

**UNIT II                      AGILE SOFTWARE DEVELOPMENT**                      **9**

Basics and Fundamentals of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, Challenges. Lean Approach: Waste Management, Kaizen and Kanban, add process and products add value. Roles related to the lifecycle, differences between Agile and traditional plans, differences between Agile plans at different lifecycle phases.

**UNIT III                      OBJECT ORIENTED ANALYSIS**                      **9**

Identifying Usecase – Business object analysis – Usecase driven object oriented analysis – Usecase model – Documentation – Classification – Identifying object, relationships, attributes, methods – Super-sub class – A part of relationships Identifying attributes and methods – Object responsibility

**UNIT IV                      DESIGN PATTERNS**                      **9**

Design Principles – Design Patterns – Various Design Concepts and notations – Real time and Distributed System Design – Documentation – Dataflow Oriented design – Jackson System development – Designing for reuse – Programming standards – Case Study for Design of any Application Project -- GRASP – GoF – Dynamic Object Modeling – Static Object Modeling.

**UNIT V                      SYSTEM TESTING**                      **9**

Software testing: Software Verification Techniques – Object Oriented Checklist:- Functional Testing – Structural Testing – Class Testing – Mutation Testing – Level of Testing – Static and Dynamic Testing Tools - Software Maintenance – Categories Challenges of Software Maintenance – Maintenance of Object Oriented Software Regression Testing.

**TEXT BOOKS:**

- 1 Yogesh Singh, Ruchika Malhotra, "Object – Oriented Software Engineering", 2<sup>nd</sup> Edition, Prentice Hall of India, 2018.
- 2 Rubin Kenneth S, "Essential Scrum: A Practical Guide to the Most Popular Agile Process", 2<sup>nd</sup> Edition, Addison-Wesley, 2020.

**REFERENCES:**

- 1 Roger S. Pressman, "Software Engineering: A Practitioner's Approach", 9<sup>th</sup> Edition, Tata McGraw-Hill Education, 2021.
- 2 Doug Rosenberg, Matt Stephens, "Use Case Driven Object Modeling with UML Theory

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- and Practice: Theory and Practice”, 2<sup>nd</sup> Edition, Academic Press, 2016.
- 3 Adair Dingle, “Object-Oriented Design Choices”, 1<sup>st</sup> Edition, Chapman and Hall, 2021.

### ONLINE RESOURCES:

- 1 <https://fall14cs.files.wordpress.com/2016/03/object-oriented-software-engineering-practical-software-development-using-uml-and-java-2005.pdf>
- 2 <https://link.springer.com/article/10.1023/A:1016593309733>
- 3 <https://archive.nptel.ac.in/courses/106/105/106105153/>

### COURSE OUTCOMES:

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

- C01 Explain the software engineering lifecycle models.
- C02 Apply the agile development processes and the principles behind the Agile Manifesto.
- C03 Design UML diagrams based on the requirements.
- C04 Design pattern and Create an application using design patterns.
- C05 Evaluate software applications using software testing techniques.

### CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C03	3	3	3	3	-	-	-	1	-	-	-	1	2	2
C04	3	3	3	3	-	-	-	1	-	-	-	1	2	2
C05	3	3	2	3	-	-	-	1	-	-	-	1	2	2

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**P23MC103**

**PYTHON PROGRAMMING**

**L T P C**

**Prerequisites: Computation and Programming Using Python**

**3 0 0 3**

**COURSE OBJECTIVES:**

- To know the basics of Python coding with conditionals, loops and functions.
- To understand the concepts of Modules, Packages, web Frameworks and OOPS concepts
- To learn the details of Files and Exception handling

**UNIT I**

**BASICS OF PYTHON**

**9**

Introduction to Python Programming – Python Interpreter and Interactive Mode– Variables and Identifiers – Arithmetic Operators – Values and Types – Statements.Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If-Else Constructs – Loop Structures/Iterative Statements –Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions – Lists, Tuples, Sets, Strings, Dictionary.

**UNIT II**

**MODULES AND PACKAGES**

**9**

Modules: Introduction – Module Loading and Execution – Packages – Making Your Own Module – The Python Libraries for data processing, data mining and visualization- Scatter plot – Line Plot – Bar Plot – Histogram - NUMPY, Pandas, Matplotlib, Plotly.

**UNIT III**

**FILE HANDLING AND EXCEPTION HANDLING**

**9**

Files: Introduction – File Path – Opening and Closing Files – Reading and Writing Files –File Position –Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

**UNIT IV**

**PYTHON WEB FRAMEWORKS**

**9**

Popular Frameworks: Django, Flask, Web2Py, Bottle, Pyramid and several other libraries. Features of Django – Django Architecture – MVC – Starting a project – Django Apps – Django Form – Form Validation.

**UNIT V**

**OBJECT ORIENTED PROGRAMMING IN PYTHON**

**9**

Creating a Class, Class methods, Class Inheritance, Encapsulation, Polymorphism, class method vs. static methods, Python object persistence.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Paul Deital and Harvey Deital, "Python for Programmers", Pearson Education, 1<sup>st</sup> Edition, 2021.
- 2 Allen B. Downey, "Think Python: How to think like a Computer scientist", 2<sup>nd</sup> Edition, O'Reilly Publishers, 2016.

**REFERENCES:**

- 1 Charles Dierbach, "Introduction to Computer Science using Python", 1<sup>st</sup> Edition, Wiley, 2022.
- 2 Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2<sup>nd</sup> Edition, Shroff, O'Reilly Publishers, 2016 (<http://greenteapress.com/wp/thinkpython/>)
- 3 John V Guttag, "Introduction to Computation and Programming Using Python", Revised and Expanded Edition, MIT Press, 2016.
- 4 Reema Thareja, "Python Programming using Problem Solving Approach", 2<sup>nd</sup> Edition, Oxford University Press, 2019.

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### ONLINE RESOURCES:

- 1 [https://onlinecourses.nptel.ac.in/noc19\\_cs41/preview](https://onlinecourses.nptel.ac.in/noc19_cs41/preview)
- 2 [https://onlinecourses.swayam2.ac.in/cec22\\_cs20/preview](https://onlinecourses.swayam2.ac.in/cec22_cs20/preview)
- 3 <https://www.python.org/about/gettingstarted/>

### COURSE OUTCOMES:

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

- C01** Explain python programs using Conditions, Loop statements and functions.  
**C02** Describe the Python Modules and Packages  
**C03** Explain python programs to read and write data from/to files.  
**C04** Apply python modules, libraries and frameworks to develop the python programs.  
**C05** Describe class, objects and its properties, methods in python.

### CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	1
C02	2	2	1	1	-	-	-	1	-	-	-	1	2	1
C03	2	2	1	1	-	-	-	1	-	-	-	1	2	1
C04	3	2	1	2	-	-	-	1	-	-	-	1	2	1
C05	2	2	1	1	-	-	-	1	-	-	-	1	2	1

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P23MC104

FUNDAMENTALS OF ACCOUNTING

L T P C

Prerequisites: Accounting Principles

3 0 2 4

COURSE OBJECTIVES:

- To understand the basic principles of Accounting, Double entry system and the preparation of ledger.
- To understand the process and importance of the electronic accounting system.
- To Prepare the estimate for various business activities such as purchase, sale, production and cash budgets

UNIT I

INTRODUCTION TO ACCOUNTING

9

Introduction to Financial, Cost and Management Accounting - Objectives of Financial Accounting - Accounting Principles, Concepts and Conventions - Bookkeeping and Accounting Practical exercise session using Tally:

UNIT II

MANAGEMENT ACCOUNTING AND BOOKKEEPING

9

Meaning-Objectives of Management Accounting-Accounting System - Preparation of Journal, Ledger, Cash Book and Trial Balance - Errors disclosed and not disclosed by Trial Balance-Final Accounts - Ratio Analysis

UNIT III

BUDGETS AND BUDGETARY CONTROL

9

Budgets and Budgetary Control-Meaning-Types-Sales Budget-Production Budget-Cost of Production Budget-Flexible Budgeting-Cash Budget-Master Budget-Zero Base Budgeting-Computerized Accounting - with adjustments

UNIT IV

FINANCIAL MANAGEMENT

9

Objectives of Financial Management- preparation of Suspense Account - Depreciation - Meaning and Types - Methods of Charging and Providing depreciation - Inventory

UNIT V

BANK RECONCILIATION STATEMENT AND REPORTING

9

Preparing Bank Reconciliation Statement (simple problems) - Insurance Claim - Average Clause -Export and Import of Data, Data Security,

PRACTICAL EXERCISES:

45 PERIODS

1. Company Creation, Creating Groups, Ledgers and Vouchers
2. Creating Contra, Journals, Credit and Debit Notes, Preparing Trial Balance and Final Accounts
3. Preparing Revenue Management and Portfolio Selection, Final Accounts with Adjustments
4. Preparing Inventory Creation, Purchase order, Sales Order
5. Preparing Sales Journal, Rejections, Delivery Note.
6. Preparing the Bank Reconciliation Statement
7. Preparing the Trading, Profit And Loss Account and Trial Balance

30 PERIODS

TOTAL: 75 PERIODS

TEXT BOOKS:

- 1 T S Reddy, A Murthy, "Financial Accounting", Margham Publication, 2023.
- 2 T S Reddy & Y Hari Prasad Reddy, "Management Accounting", Margham Publications, 2020.

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## REFERENCES:

- 1 S N Maheswari, "Financial and Management Accounting", 7<sup>th</sup> Edition, Sultan Chand & Sons, 2021.
- 2 I M Pandey, "Financial Management", 13<sup>th</sup> Edition, Vikas Publishing House Pvt. Ltd., 2020.
- 3 M Y Khan, P K Jain, "Financial Management, Text, Problems and Cases", 8<sup>th</sup> Edition, Tata McGraw Hill, 2018.
- 4 I M Pandey, "Management Accounting", 10<sup>th</sup> Edition, Vikas Publishing House Pvt. Ltd., 2019.
- 5 R L Gupta, P K Gupta, "Advanced Accounting", Sultan Chand, 2019.

## ONLINE RESOURCES:

- 1 [https://icmai.in/upload/Students/Syllabus-2012/Study\\_Material\\_New/Inter-Paper5-Revised.pdf](https://icmai.in/upload/Students/Syllabus-2012/Study_Material_New/Inter-Paper5-Revised.pdf)
- 2 <https://corporatefinanceinstitute.com/resources/accounting/principles-accounting-book-pdf/>
- 3 <https://openstax.org/details/books/principles-financial-accounting>

## COURSE OUTCOMES:

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

- C01 Explain the concepts of Financial Accounting.
- C02 Create the transaction to the journal, ledger and financial statements.
- C03 Analyze various types of budgets.
- C04 Evaluate the charges for depreciation on fixed assets.
- C05 Create a bank reconciliation statement.

## CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1		1	-	1	1	1
C02	3	3	3	3	-	-	-	1		1	-	1	1	1
C03	3	3	2	2	-	-	-	1		1	-	1	1	1
C04	3	3	2	3	-	-	-	1		1	-	1	1	1
C05	3	3	3	3	-	-	-	1		1	-	1	1	1

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P23MC105

**ADVANCED DATA STRUCTURES AND ALGORITHMS  
LABORATORY**

L T P C

**Prerequisites: Data Structures and Design and Analysis of Algorithms  
laboratory**

0 0 3 1.5

**COURSE OBJECTIVES:**

- To acquire the fundamental design, analysis, and implementation of basic data structures
- To understand the usage of heap, graph structures and spanning trees
- To understand the problems such as matrix chain multiplication, activity selection and Huffman coding

**LIST OF EXPERIMENTS:**

- 1 Implementation of recursive function for tree traversal and Fibonacci
- 2 Implementation of iteration function for tree traversal and Fibonacci
- 3 Implementation of Merge Sort and Quick Sort
- 4 Implementation of a Binary Search Tree: Red-Black Tree Implementation
- 5 Heap Implementation
- 6 Fibonacci Heap Implementation
- 7 Graph Traversals
- 8 Spanning Tree Implementation
- 9 Shortest Path Algorithms (Dijkstra's algorithm, Bellman Ford Algorithm)
- 10 Implementation of Matrix Chain Multiplication
- 11 Activity Selection and Huffman Coding Implementation

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

- CO1** Create a program that encompasses both basic and advanced data structure.
- CO2** Create a tree structure using various algorithms.
- CO3** Create a program using sorting techniques.
- CO4** Write a program for the shortest path algorithms.
- CO5** Design algorithms using design techniques.

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	-	1	1	1	-	1	2	2
CO2	3	3	3	3	-	-	-	1	1	1	-	1	2	2
CO3	3	3	3	3	-	-	-	1	1	1	-	1	2	2
CO4	3	3	3	3	-	-	-	1	1	1	-	1	2	2
CO5	3	3	3	3	-	-	-	1	1	1	-	1	2	2

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P23MC106

**PYTHON PROGRAMMING LABORATORY**

L T P C

Prerequisites: C Programming Laboratory

0 0 3 1.5

**COURSE OBJECTIVES:**

- To learn Python programs with conditionals, loops, functions, lists, tuples and dictionaries
- To Read and write data from/to files in Python
- To Implement object oriented concepts, Numpy and Scipy Python Libraries

**LIST OF EXPERIMENTS:**

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines.

- 1 Scientific problems using Conditionals and Iterative loops.
- 2 Programs to implement basic data types, strings and numeric data types.
- 3 Implementing applications using the Lists, Tuples.
- 4 Implementing applications using the Sets, and Dictionaries.
- 5 Programming using functions in python
- 6 Import basic packages and libraries and execute programs
- 7 Working with Python packages - Numpy, Scipy, Scikit-learn, Matplotlib
- 8 Implementing real-time/technical applications using File handling.
- 9 Implementing real-time/technical applications using Exception handling.
- 10 Creating and Instantiating a simple class using python.
- 11 Working with Data visualization - Scatter Plot, Line Plot, Bar plot and Histogram
- 12 Implementing Machine Learning applications using Python packages.

**COURSE OUTCOMES:**

**TOTAL: 45 PERIODS**

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

- CO1 Write a python programs for simple computational problems.
- CO2 Write python programs with conditionals and loops.
- CO3 Write a python programs step-wise by defining function and calling them.
- CO4 Design a python programs using lists, tuples, and dictionaries for representing compound data.
- CO5 Design a python program for read and write data from to files in python.

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	-	2	2	2	-	1	3	2
CO2	3	3	3	3	2	-	-	2	2	2	-	1	3	2
CO3	3	3	3	3	2	-	-	2	2	2	-	1	3	2
CO4	3	3	3	3	2	-	-	2	2	2	-	1	3	2
CO5	3	3	3	3	2	-	-	2	2	2	-	1	3	2

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**P23EN101 COMMUNICATION SKILLS LABORATORY**

L	T	P	C
0	0	2	1

**Prerequisites: Basics of LSRW skills****COURSE OBJECTIVES:**

- To provide opportunities to learners to practice their communication skills.
- To enhance the performance of learners at various recruitment procedures.
- To improve the performance of students' listening, speaking, reading and writing skills.

**LIST OF ACTIVITIES:**

1. Listening:
  - Listening and practicing neutral accents
  - Listening to short talks and lectures and completing listening comprehension exercises
  - Listening to TED Talks
2. Speaking:
  - Giving one minute talks
  - Introducing oneself to the Audience & Topic
  - Participating in Group Discussions and Making Presentations
  - Attending job interviews - Answering questions confidently
3. Reading:
  - Reading Comprehension
  - Reading subject specific material
  - Technical Vocabulary
4. Writing:
  - Formal vs Informal Writing
  - Paragraph, Essay and Email Writing
5. Soft Skills
  - People skills
  - Interpersonal and leadership skills
  - Team building skills
6. Problem solving skills

**TOTAL: 30 PERIODS****COURSE OUTCOMES:****Upon the completion of the course, the students will be able to**

- CO1** Comprehend Information through Listening to give appropriate responses.  
**CO2** Apply speaking skills of Group Discussion, Presentation and attend Job Interviews.  
**CO3** Apply Reading Skills to be a professional in all aspects.  
**CO4** Write Formal and Informal Emails, Essays, and Paragraphs.  
**CO5** Apply various kinds of Soft Skills in a Professional Context.

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	1	-	-	1	1	1	-	1	-	-
CO2	3	-	-	-	1	-	-	1	1	1	-	1	-	-
CO3	3	-	-	-	1	-	-	1	1	1	-	1	-	-
CO4	3	-	-	-	1	-	-	1	1	1	-	1	-	-
CO5	3	-	-	-	1	-	-	1	1	1	-	1	-	-

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## SEMESTER II

P23MC201

### FULL STACK WEB DEVELOPMENT

Prerequisites: Web Application Development

L T P C  
3 0 0 3

#### COURSE OBJECTIVES:

- To understand the fundamentals of web programming, client-side scripting and server side development using NodeJS.
- To understand API development with Express Framework.
- To learn the advanced client side scripting and ReactJS framework.

#### UNIT I

#### INTRODUCTION TO CSS and JAVASCRIPT

9

Introduction to Web: Server - Client - Communication Protocol (HTTP) – Structure of HTML Documents – Basic Markup tags – Working with Text and Images with CSS– CSS Selectors – CSS Flexbox - JavaScript: Data Types and Variables - Functions - Events – AJAX: GET and POST.

#### UNIT II

#### SERVER SIDE PROGRAMMING WITH NODE JS

9

Introduction to Web Servers – Javascript in the Desktop with NodeJS – NPM – Serving files with the http module – Introduction to the Express framework – Server-side rendering with Templating Engines – Static Files - async/await - Fetching JSON from Express.

#### UNIT III

#### ADVANCED NODE JS AND DATABASE

9

Introduction to NoSQL databases – MongoDB system overview - Basic querying with MongoDB shell – Request body parsing in Express – NodeJS MongoDB connection – Adding and retrieving data to MongoDB from NodeJS – Handling SQL databases from NodeJS – Handling Cookies in NodeJS – Handling User Authentication with NodeJS.

#### UNIT IV

#### ADVANCED CLIENT SIDE PROGRAMMING

9

React JS: ReactDOM - JSX - Components - Properties – Fetch API - State and Lifecycle - -JS LocalStorage - Events - Lifting State Up - Composition and Inheritance.

#### UNIT V

#### APP IMPLEMENTATION IN CLOUD

9

Cloud providers Overview – Virtual Private Cloud – Scaling (Horizontal and Vertical) – Virtual Machines, Ethernet and Switches – Docker Container – Kubernetes.

**TOTAL: 45 PERIODS**

#### TEXT BOOKS:

- 1 David Flanagan, "Java Script: The Definitive Guide", 7<sup>th</sup> Edition, O'Reilly Media, 2020.
- 2 Paul Zikopoulos, Christopher Bienko, Chris Backer, Chris Konarski, Sai Vennam, "Cloud Without Compromise", 1<sup>st</sup> Edition, O'Reilly Media, 2021.
- 3 Matt Frisbie, "Professional JavaScript for Web Developers", 4<sup>th</sup> Edition, John Wiley & Sons, 2019.

#### REFERENCES:

- 1 Alex Banks, Eve Porcello, "Learning React", 2<sup>nd</sup> Edition, O'Reilly Media, 2020
- 2 Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and Angular Web Development", 2<sup>nd</sup> Edition, Addison-Wesley, 2018.
- 3 Vasanth Subramanian, "Pro MERN Stack: Full Stack Web App Development with MongoDB, Express, React, and Node", 2<sup>nd</sup> Edition, Apress, 2019.

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- 4 Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', 1<sup>st</sup> Edition, Apress, 2018.

#### ONLINE RESOURCES:

- 1 <https://www.coursera.org/articles/full-stack-developer>
- 2 <https://www.geeksforgeeks.org/what-is-full-stack-development/>
- 3 <https://www.simplilearn.com/skills-required-to-become-a-full-stack-developer-article>

#### COURSE OUTCOMES:

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

- CO1** Explain the process of client side scripting.  
**CO2** Apply server-side programming with NodeJs.  
**CO3** Create a NOSQL database using NodeJs.  
**CO4** Describe advanced client-side programming.  
**CO5** Design an application using cloud deploy.

#### CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO2	3	2	1	2	-	-	-	1	-	-	-	1	2	2
CO3	3	3	3	3	-	-	-	1	-	-	-	1	2	2
CO4	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO5	3	3	3	3	-	-	-	1	-	-	-	1	2	2

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P23MC202

**ADVANCED DATABASE TECHNOLOGY**

L T P C  
3 0 0 3

**Prerequisites:** Database Management Systems

**COURSE OBJECTIVES:**

- To understand the working principles and query processing of distributed databases.
- To understand the basics of spatial, temporal, mobile databases, NoSQL databases and their applications.
- To understand the basics of XML and create well-formed and valid XML documents and gain knowledge about information retrieval and web search.

**UNIT I**

**DISTRIBUTED DATABASES**

9

Distributed Systems - Introduction - Architecture - Distributed Database Concepts - Distributed Data Storage - Distributed Transactions - Commit Protocols - Concurrency Control - Distributed Query Processing.

**UNIT II**

**SPATIAL AND TEMPORAL DATABASES**

9

Active Databases Model - Design and Implementation Issues - Temporal Databases - Temporal Querying - Spatial Databases: Spatial Data Types, Spatial Operators and Queries - Spatial Indexing and Mining - Applications -- Mobile Databases: Location and Handoff Management, Mobile Transaction Models - Deductive Databases - Multimedia Databases.

**UNIT III**

**NOSQL DATABASES**

9

NoSQL - CAP Theorem - Sharding - Document based - MongoDB Operation: Insert, Update, Delete, Query, Indexing, Application, Replication, Sharding - Cassandra: Data Model, Key Space, Table Operations, CRUD Operations, CQL Types - HIVE: Data types, Database Operations, Partitioning - HiveQL - OrientDB Graph database - OrientDB Features.

**UNIT IV**

**XML DATABASES**

9

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

**UNIT V**

**INFORMATION RETRIEVAL AND WEB SEARCH**

9

IR concepts - Retrieval Models - Queries in IR system - Text Preprocessing - Inverted Indexing - Evaluation Measures - Web Search and Analytics - Current trends.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Abraham Silberschatz, Henry F Korth, S Sudharshan, "Database System Concepts", 7<sup>th</sup> Edition, Tata McGraw Hill, 2019.
- 2 R Elmasri, S B Navathe, "Fundamentals of Database Systems", 7<sup>th</sup> Edition, Pearson Education, 2017.

**REFERENCES:**

- 1 Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", 4<sup>th</sup> Edition, Morgan Kaufmann, 2022.
- 2 Guy Harrison, "Next Generation Databases, NoSQL, NewSQL and Big Data", 1<sup>st</sup> Edition, Apress, 2016.
- 3 Guy Harrison, "Next Generation Databases, NoSQL, NewSQL and Big Data", 1<sup>st</sup> Edition, Apress, 2022.

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### ONLINE RESOURCES:

- 1 <https://learn.mongodb.com/learning-paths/introduction-to-mongodb>
- 2 [https://cassandra.apache.org/\\_/quickstart.html](https://cassandra.apache.org/_/quickstart.html)
- 3 <https://www.udemy.com/course/from-0-to-1-hive/?couponCode=NVDPRODIN35>

### COURSE OUTCOMES:

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

- C01** Design, deploy and manage distributed database systems.
- C02** Create Spatial, Temporal, Mobile and Multimedia databases and perform its operations.
- C03** Create NoSQL database system and manipulate the data associated with it.
- C04** Develop XML Databases by using XML Technologies including XML DTD, XSLT, XPath and XQuery.
- C05** Apply the Concept of Information Retrieval and Web Search in Web Databases.

### CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	3	3	-	-	-	1	-	-	-	1	2	2
C02	3	3	3	3	-	-	-	1	-	-	-	1	2	2
C03	3	3	3	3	-	-	-	1	-	-	-	1	2	2
C04	3	3	3	3	-	-	-	1	-	-	-	1	2	2
C05	3	2	1	2	-	-	-	1	-	-	-	1	2	2

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**P23MC203**

**CLOUD COMPUTING TECHNOLOGIES**

**L T P C**

**Prerequisites: Fundamentals of Distributed Systems**

**3 0 0 3**

**COURSE OBJECTIVES:**

- To learn about the current trend and basics of Cloud computing.
- To expose the technologies that enhance cloud computing such as execution environment virtualization, storage virtualization and distributed storage
- To be aware of Microservices and DevOps.

**UNIT I**

**DISTRIBUTED SYSTEMS**

**9**

Introduction to Distributed Systems – Characterization of Distributed Systems – Distributed Architectural Models – Remote Invocation – Request-Reply Protocols – Remote Procedure Call – Remote Method Invocation – Group Communication – Coordination in Group Communication – Ordered Multicast – Time Ordering – Physical Clock Synchronization – Logical Time and Logical Clocks.

**UNIT II**

**BASICS OF CLOUD COMPUTING**

**9**

Cloud Computing Basics – Desired features of Cloud Computing – Elasticity in Cloud – On demand provisioning – Applications – Benefits – Cloud Components: Clients, Datacenters & Distributed Servers – Characterization of Distributed Systems – Distributed Architectural Models – Principles of Parallel and Distributed computing – Applications of Cloud computing – Benefits – Cloud services – Open source Cloud Software: Eucalyptus, Open Nebula, Open stack, Aneka, Cloudsim.

**UNIT III**

**CLOUD INFRASTRUCTURE**

**9**

Cloud Architecture and Design – Architectural design challenges – Technologies for Network based system – NIST Cloud computing Reference Architecture – Public, Private and Hybrid clouds – Cloud Models : IaaS, PaaS and SaaS – Cloud storage providers – Enabling Technologies for the Internet of Things – Innovative Applications of the Internet of Things.

**UNIT IV**

**CLOUD ENABLING TECHNOLOGIES**

**9**

Service Oriented Architecture – Web Services – Basics of Virtualization – Emulation – Types of Virtualization – Implementation levels of Virtualization – Virtualization structures – Tools & Mechanisms – Virtualization of CPU, Memory & I/O Devices – Desktop Virtualization – Server Virtualization – Google App Engine – Amazon AWS – Federation in the Cloud.

**UNIT V**

**MICROSERVICES AND DEVOPS**

**9**

Defining Microservices – Emergence of Microservice Architecture – Design patterns of Microservices – The Mini web service architecture – Microservice dependency tree – Challenges with Microservices – SOA vs Microservice – Microservice and API – Deploying and maintaining Microservices – Reason for having DevOps – Overview of DevOps – Core elements of DevOps – Life cycle of DevOps – Adoption of DevOps – DevOps Tools – Build, Promotion and Deployment in DevOps.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Cornelia Davis, "Cloud Native Patterns: Designing Change-Tolerant Software", 1<sup>st</sup> Edition, Manning Publishers, 2019
- 2 Andrew S. Tanenbaum & Maarten Van Steen, "Distributed Systems - Principles and

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## REFERENCES:

- 1 Magnus Larsson, "Hands-On Microservices with Spring Boot and Spring Cloud: Build and deploy microservices using spring cloud, Istio and kubernetes", 1<sup>st</sup> Edition, Packt Publishing Ltd, September 2019.
- 2 Richard Rodger, "The Tao of Microservices", Manning Publications, 1<sup>st</sup> Edition, December 2017.
- 4 Jim Lewis, "DEVOPS: A complete beginner's guide to DevOps best practices", ISBN-13:978-1673259148, ISBN-10: 1673259146, 1<sup>st</sup> Edition, 2019.

## ONLINE RESOURCES:

- 1 <https://aws.amazon.com>
- 2 <https://www.edx.org/learn/cloud-computing>
- 3 <https://www.guvi.in/blog/websites-to-learn-cloud-computing>

## COURSE OUTCOMES:

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

- C01 Explain the design principles in distributed systems and the architectures for distributed systems.
- C02 Describe the basics of Cloud Computing.
- C03 Explain the service models (IaaS, PaaS, SaaS) and deployment models (public, private, hybrid) in cloud computing.
- C04 Apply cloud enabling technologies.
- C05 Describe Microservices and Devops concepts.

## CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	-	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	-	-	-	-	1	2	2
C03	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C04	3	2	1	2	-	-	-	-	-	-	-	1	2	2
C05	2	2	1	1	-	-	-	-	-	-	-	1	2	2

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**P23MC204**

**PROGRAMMING WITH JAVA**

**L T P C**

**Prerequisites: Java Programming Fundamentals**

**3 0 2 4**

**COURSE OBJECTIVES:**

- To understand the basic concepts and fundamentals of platform independent object oriented language.
- To demonstrate skills in writing programs using exception handling techniques and multithreading
- To introduce the design of Graphical User Interface using applets and swing controls and the implementation of packages and interfaces

**UNIT I**

**JAVA FUNDAMENTALS**

**9**

Java features - Java Platform - Java Fundamentals - Expressions, Operators, and Control Structures - Classes, Methods - Inheritance - Packages and Interfaces - Boxing, Unboxing - Variable-Length Arguments (Varargs), Exception Handling.

**UNIT II**

**COLLECTIONS AND ADVANCE FEATURES**

**9**

Utility Packages- Introduction to collection -Hierarchy of Collection framework - Generics, Array list, LL, HashSet, TreeSet, HashMap - Comparators - Java annotations - Premain method.

**UNIT III**

**ADVANCED JAVAPROGRAMMING**

**9**

Input Output Packages - Inner Classes - Java Database Connectivity - Introduction JDBC Drivers - JDBC connectivity with MySQL/Oracle -Prepared Statement & Result Set - JDBC Stored procedures invocation - Servlets - RMI - Swing Fundamentals - Swing Classes.

**UNIT IV**

**OVERVIEW OF DATA RETRIEVAL & ENTERPRISE APPLICATION DEVELOPMENT**

**9**

Tiered Application development - Java Servers, containers -Web Container - Creating Web Application using JSP/Servlets - Web Frameworks Introduction to Spring/ Play Framework - ORM Layer - Introduction to Hibernate.

**UNIT V**

**JAVA INTERNALS AND NETWORKING**

**9**

Java jar Files-Introspection - Garbage collection - Architecture and design - GC Cleanup process, Invoking GC, Generation in GC - Networking Basics Java and the Net - Inet Address - TCP/IP Client Sockets - URL -URL Connection - TCP/IP Server Sockets - A Caching Proxy HTTP Server - Datagrams.

**PRACTICAL EXERCISES:**

**45 PERIODS**

- 1 Writing Java programs by making use of class, interface, package, etc.
- 2 Writing window based GUI applications using frames and applets such as Calculator application, Fahrenheit to Centigrade conversion etc.
- 3 Application of threads examples.
- 4 Event Handling in Swing.
- 5 Reading and writing text files.
- 6 Writing a Servlet program with database connectivity for a web based application such as students result status checking, PNR number enquiry etc.
- 7 Creation and usage of Java bean

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**30 PERIODS**  
**TOTAL: 75 PERIODS**

**TEXT BOOKS:**

- 1 Vaskaran Sarcar, "Java Design Patterns: A Hands-On Experience with Real-World Examples", Apress, 2022.
- 2 Herbert Schildt, The Complete Reference – Java 2, 5<sup>th</sup> Edition, Tata McGraw Hill, 2017.
- 3 Joyce Farrell, "Java Programming", 9<sup>th</sup> Edition, Cengage Learning, 2018.

**REFERENCES:**

- 1 H M Dietel, P J Dietel, "Java How to Program", 11<sup>th</sup> Edition, Pearson Education, 2017.
- 2 Vishwajit Barbuddhe, Shraddha N Zanjat, Bhavana S Karmore, "Object Oriented Programming Through Java," Lambert Academic Publishing, 2020.
- 3 Vaskaran Sarcar, "Interactive Object-Oriented Programming in Java: Learn and Test Your Programming Skills", Apress, 2019.

**ONLINE RESOURCES:**

- 1 <https://archive.nptel.ac.in/noc/courses/noc21/SEM1/noc21-cs03/>
- 2 <https://www.infoworld.com/article/2074929/my-favorite-online-resources-for-advanced-java-developers.html/>
- 3 <https://qubit-labs.com/free-resources-learn-java-programming-online/>

**COURSE OUTCOMES:**

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

- CO1 Explain the concepts of Java Programming.
- CO2 Apply the Collection framework hierarchy on Java applications.
- CO3 Explain the database connectivity using JDBC.
- CO4 Create web based program using servlet and JSP.
- CO5 Create a real time application using a Hash map and Java Bean.

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO2	3	2	1	2	-	-	-	1	-	-	-	1	2	2
CO3	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO4	3	3	3	3	-	-	-	1	-	-	-	1	2	2
CO5	3	3	3	3	-	-	-	1	-	-	-	1	2	2

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P23MC205

## BIG DATA ANALYTICS

L T P C

Prerequisites: Data Mining, Data Engineering

3 0 0 3

### COURSE OBJECTIVES:

- To understand the concept of big data and its significance in contemporary data-driven decision-making
- To explore the challenges and opportunities associated with handling large volumes of diverse data sources
- To know the principles of machine learning and its application in big data analytics

### UNIT I

#### INTRODUCTION TO BIG DATA

9

Introduction – Understanding Big Data – Big Data: Benefiting – Managing – Organizing and Analyzing Big Data: Learning and Analytics; Technology Challenges for Big Data- Modern Data Analytic Tools- Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

### UNIT II

#### SEARCH METHODS AND VISUALIZATION

9

Search by simulated Annealing – Stochastic, Adaptive search by Evaluation – Evaluation Strategies – Genetic Algorithm – Genetic Programming – Visualization – Classification of Visual Data Analysis Techniques – Data Types – Visualization Techniques – Interaction techniques – Specific Visual data analysis Techniques

### UNIT III

#### MINING DATA STREAMS

9

Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP)Applications -- Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

### UNIT IV

#### HADOOP ENVIRONMENT

9

History of Hadoop- The Hadoop Distributed File System – Components of Hadoop- Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Hadoop filesystems-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 - Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation – Hadoop Configuration-Security in Hadoop .

### UNIT V

#### FRAMEWORKS AND APPLICATIONS

9

IBM for Big Data –Framework - Hive – Sharding – NoSQL Databases –Mango DB-Casandra- Hbase – Impala – Analyzing big data with twitter – Big data for Ecommerce – Big data for blogs.

**TOTAL: 45 PERIODS**

### TEXT BOOKS:

- 1 Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", 3<sup>rd</sup> Edition, Cambridge University Press, 2020.
- 2 Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding BigData: Analytics for Enterprise Class Hadoop and Streaming Data", Tata McGraw Hill, 2017.

### REFERENCES:

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- 1 Subhashini Chellappan Seema Acharya, "Big Data and Analytics", John Wiley & Sons, 2019.
- 2 Glenn J Myatt, "Making Sense of Data", John Wiley & Sons, 2014.
- 3 Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", 3<sup>rd</sup> Edition, Elsevier, Reprinted 2011.
- 4 David Hand, Michael R. Berthold, Hand, "Intelligent Data Analysis: An Introduction", Springer, 2019.
- 5 Mayank Bhushan "Big Data and Hadoop: Fundamentals, Tools, and Techniques for Data-Driven Success" 2<sup>nd</sup> Edition, BPB Publications, 2024.

**ONLINE RESOURCES:**

- 1 <https://www.mooc-list.com/tags/big-data-analytics>
- 2 [https://onlinecourses.nptel.ac.in/noc20\\_cs92/preview](https://onlinecourses.nptel.ac.in/noc20_cs92/preview)
- 3 <https://www.coursera.org/specializations/big-data>

**COURSE OUTCOMES:**

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

- CO1** Analyze the fundamentals of various big data analysis techniques.
- CO2** Apply the big data analytic techniques for useful business applications.
- CO3** Summarize efficient algorithms for mining the data from large volumes.
- CO4** Describe HADOOP and Map Reduce technologies associated with big data analytics.
- CO5** Explain the applications of Big Data

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3	3	2	2	-	-	-	1	-	-	-	-	2	2
<b>CO2</b>	3	2	1	2	-	-	-	1	-	1	-	-	2	2
<b>CO3</b>	2	2	1	1	1	-	-	1	-	-	1	-	2	2
<b>CO4</b>	2	2	1	1		-	-	1	-	-	-	-	2	2
<b>CO5</b>	2	2	1	1	1	-	-	1	-	-	-	-	2	2

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Prerequisites: Database Management Systems Laboratory

### COURSE OBJECTIVES:

- To understand the process of distributing tables across multiple systems.
- To understand the process of storing, retrieving spatial, temporal and NoSQL data.
- To understand the process of storing and retrieving data from a XML Database To use the open source database for building a mobile application.

### LIST OF EXPERIMENTS:

- NOSQL Exercises
  - MongoDB – CRUD operations, Indexing, Sharding
  - Cassandra: Table Operations, CRUD Operations, CQL Types
- HIVE: Data types, Database Operations, Partitioning – HiveQL
- MySQL Database Creation, Table Creation, Query
- MySQL Replication – Distributed Databases
- Spatial data storage and retrieval in MySQL
- Temporal data storage and retrieval in MySQL
- Object storage and retrieval in MySQL
- XML Databases, XML table creation, XQuery FLWOR expression
- XML DTD Creation, Internal DTD and External DTD
- Mobile Database Query Processing using open source DB (MongoDB/MySQL etc).
- Distributed Database creation
- OrientDB Graph database – OrientDB Features

**TOTAL: 45 PERIODS**

### Course Outcome

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

- C01** Create Distributed databases and perform its operations.  
**C02** Create spatial and temporal databases and implement its process.  
**C03** Create different types of NOSQL databases and perform CRUD operations  
**C04** Create an XML databases and perform Xquery expression.  
**C05** Create mobile databases using open source database tools.

### CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	3	3	-	-	-	1	-	1	-	1	2	2
C02	3	3	3	3	-	-	-	1	-	1	-	1	2	2
C03	3	3	3	3	-	-	-	1	-	1	-	1	2	2
C04	3	3	3	3	-	-	-	1	-	1	-	1	2	2
C05	3	3	3	3	-	-	-	1	-	1	-	1	2	2

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**COURSE OBJECTIVES:**

- To Develop and present visually appealing and functional front-end and back-end components or projects.
- To Create, manipulate databases, performing CRUD operations, and optimizing queries
- To develop a full stack single page application using React, NodeJS, etc and a Database like MongoDB or SQL.

**LIST OF EXPERIMENTS:**

- 1 Create a form and validate the contents of the form using JavaScript.
- 2 Get data using Fetch API from an open-source endpoint and display the contents in the form of a card.
- 3 Create a NodeJS server that serves static HTML and CSS files to the user without using express.
- 4 Create a NodeJS server using Express that stores data from a form as a JSON file and displays it in another page. The redirect page should be prepared using Handlebars.
- 5 Create a NodeJS server using Express that creates, reads, updates and deletes students' details and stores them in MongoDB database. The information about the user should be obtained from a HTML form.
- 6 Create a NodeJS server that creates, reads, updates and deletes event details and stores them in a MySQL database. The information about the user should be obtained from a HTML form.
- 7 Create a counter using ReactJS
- 8 Create a Todo application using ReactJS. Store the data to a JSON file using a simple NodeJS server and retrieve the information from the same during page reloads.
- 9 Create a simple Sign up and Login mechanism and authenticate the user using cookies. The user information can be stored in either MongoDB or MySQL and the server should be built using NodeJS and Express Framework.
- 10 Create and deploy a virtual machine using a virtual box that can be accessed from the host computer using SSH.
- 11 Create a docker container that will deploy a NodeJS ping server using the NodeJS image.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

- CO1 Create a web pages using HTML and CSS.
- CO2 Create client-side programming with NodeJs.
- CO3 Create a query for MongoDB and Mysql.
- CO4 Create a web pages using ReactJs.
- CO5 Create real-world web application using NodeJs and MongoDB.

**CO-PO-PSO Mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	3	3	3	-	-	-	1	-	1	-	1	2	2
CO2	3	3	3	3	-	-	-	1	-	1	-	1	2	2
CO3	3	3	3	3	-	-	-	1	-	1	-	1	2	2
CO4	3	3	3	3	-	-	-	1	-	1	-	1	2	2
CO5	3	3	3	3	-	-	-	1	-	1	-	1	2	2

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## SEMESTER III

P23MC301

### MACHINE LEARNING

L T P C

Prerequisites: Probability and Statistics

3 0 0 3

#### COURSE OBJECTIVES:

- To understanding of the fundamental concepts, algorithms, and techniques in machine learning
- To analyse various evaluation metrics and techniques for assessing the performance of machine learning models
- To explore real-world applications of machine learning across various domains.

#### UNIT I

##### INTRODUCTION

9

Human Learning - Types - Machine Learning - Types - Problems not to be solved - Applications Languages/Tools- Issues. Preparing to Model: Introduction - Machine Learning Activities - Types of data - Exploring structure of data - Data quality and remediation - Data Pre-processing.

#### UNIT II

##### MODEL EVALUATION AND FEATURE ENGINEERING

9

Model Selection - Training Model - Model Representation and Interpretability - Evaluating Performance of a Model - Improving Performance of a Model - Feature Engineering: Feature Transformation - Feature Subset Selection

#### UNIT III

##### SUPERVISED LEARNING

9

Classification: Classification and Regression Trees (CART) - Random Forest - K Nearest Neighbors - Support vector machines. Bayes theorem - Naïve Bayes - Bayesian belief network. Regression: Linear Regression, Multiple Linear Regression, Logistic Regression.

#### UNIT IV

##### UNSUPERVISED LEARNING

9

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

#### UNIT V

##### ADVANCED LEARNING TECHNIQUES

9

Reinforcement Learning - State and action space - Reward function - Discounting - Action selection - Policy - Markov decision process - Q-learning. Active Learning - Ensemble Learning - Bootstrap Aggregation - Boosting - Gradient Boosting Machines - Deep learning


#### TEXT BOOKS:

TOTAL: 45 PERIODS

- 1 Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning Series)", 3<sup>rd</sup> Edition, MIT Press, 2020
- 2 Tom M. Mitchell, "Machine Learning", India Edition, 1<sup>st</sup> Edition, Tata McGraw Hill, 2017

#### REFERENCES:

- 1 Aurelien Geron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2<sup>nd</sup> Edition, O'Reilly, 2022.
- 2 Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Recognition", Wiley & Sons, 2021.
- 3 Saikat Dutt, Subramanian Chandramouli and Amit Kumar Das, "Machine Learning", 1<sup>st</sup> Edition, Pearson Education, 2019.

  
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### ONLINE REFERENCES:

- 1 <https://www.coursera.org/specializations/machine-learning-introduction>
- 2 <https://youtu.be/vStJoetOxJg>
- 3 [https://onlinecourses.nptel.ac.in/noc23\\_cs18/preview](https://onlinecourses.nptel.ac.in/noc23_cs18/preview)

### COURSE OUTCOMES:

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

- C01 Describe the different types of learning, data and pre-processing techniques
- C02 Evaluate the performance of a model and use feature engineering techniques.
- C03 Apply the supervised machine learning algorithms to classify the data.
- C04 Analyze various unsupervised machine learning algorithms.
- C05 Analyze advanced machine learning techniques to resolve the given problems.

### CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	-	2	2
C02	3	3	2	3	-	-	-	1	-	-	-	-	2	2
C03	3	2	1	2	-	-	-	1	-	-	-	-	2	2
C04	3	3	2	2	-	-	-	1	-	-	-	-	2	2
C05	3	3	2	2	-	-	-	1	-	-	-	1	2	2

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*Dr. G. Durga Devi*



P23MC302

**MOBILE APPLICATION DEVELOPMENT**

**L T P C**

**Prerequisites: Application Development**

**3 0 2 4**

**COURSE OBJECTIVES:**

- To describe the aspects of mobile programming that make it unique for other platforms.
- To utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
- To create an innovative and robust mobile applications.

**UNIT I**

**INTRODUCTION**

**9**

Mobile Application Model – Infrastructure and Managing Resources – Mobile Device Profiles – Frameworks and Tools.

**UNIT II**

**USER INTERFACE**

**9**

Generic UI Development - Multimodal and Multichannel UI –Gesture Based UI – Screen Elements and Layouts – Voice XML.

**UNIT III**

**APPLICATION DESIGN**

**9**

Memory Management – Design Patterns for Limited Memory – Workflow for Application development – Java API – Dynamic Linking – Plugins and rule of thumb for using DLLs – Multithreading in Java - Concurrency and Resource Management.

**UNIT IV**

**MOBILE OS**

**9**

Mobile OS: Android, iOS – Android Application Architecture – Understanding the anatomy of a mobile application - Android basic components –Intents and Services – Storing and Retrieving data – Packaging and Deployment – Security and Hacking.

**UNIT V**

**APPLICATION DEVELOPMENT**

**9**

Communication via the Web – Notification and Alarms – Graphics and Multimedia: Layer Animation, Event handling and Graphics services – Telephony – Location based services

**45 PERIODS**

**PRACTICAL EXERCISES:**

- 1 Develop an application that uses Layout Managers and Event Listeners.
- 2 Develop an Application using Adapter, Toast and Databases.
- 3 Develop and application that makes use of RSS feed.
- 4 Implement an application that implements Multithreading.
- 5 Develop a native application that uses GPS Location information
- 6 Implement an application that creates an alert upon receiving a message.
- 7 Implement an application that writes data to the SD card.

**30 PERIODS**

**TOTAL: 75 PERIODS**

**TEXT BOOKS:**

- 1 Zigurd Mednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, “Programming Android”, 2<sup>nd</sup> Edition, O’Reilly, 2021.
- 2 Reto Meier, Ian Lake, “Professional Android”, 4<sup>th</sup> Edition, Wrox, 2018.

**REFERENCES:**

- 1 Bill Phillips, Chris Stewart, Brian Hardy, Kristin Marsicano, “Android

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- Programming: The Big Nerd Ranch Guide”, 5<sup>th</sup> Edition, Big Nerd Ranch Guides, 2022.
- 2 Christian Keur, Aaron Hillegass, “iOS Programming: The Big Nerd Ranch Guide”, 7<sup>th</sup> Edition, Big Nerd Ranch Guides, 2022.
  - 3 Barry Burd, “Android Application Development All-In-One for Dummies”, 3<sup>rd</sup> Edition, For Dummies, 2021.

**ONLINE RESOURCES:**

- 1 <https://www.ibm.com/topics/mobile-application-development>
- 2 <https://www.techtarget.com/searchapparchitecture/definition/mobile-application-development>
- 3 <https://developer.android.com/>

**COURSE OUTCOMES:**

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

- C01** Explain the concept of mobile application framework.
- C02** Apply XML programming to design an UI model.
- C03** Design an application in dynamic environment.
- C04** Create an application using mobile based operating system.
- C05** Design a real-time application using Graphics and Multimedia.

**CO - PO-PSO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>C01</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2
<b>C02</b>	3	2	1	2	-	-	-	1	-	-	-	1	2	2
<b>C03</b>	3	3	3	3	-	-	-	1	-	-	-	1	2	2
<b>C04</b>	3	3	3	3	-	-	-	1	-	-	-	1	2	2
<b>C05</b>	3	3	3	3	-	-	-	1	-	-	-	1	2	2

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**COURSE OBJECTIVES:**

- To understand the basics of cyber security, cyber crimes and cyber law.
- To learn about data privacy and data security.
- To know about cyber security management, compliance and governance.

**UNIT I****OVERVIEW OF CYBER SECURITY**

9

Cyber security increasing threat landscape, Cyber security terminologies- Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker., Non-state actors, Cyber terrorism, Protection of end user machine, Critical IT and National Critical Infrastructure, Cyberwarfare, Case Studies..

**UNIT II****CYBER CRIMES**

9

Cyber crimes targeting Computer systems and Mobiles- data diddling attacks, spyware, logic bombs, DoS, DDoS, APTs, virus, Trojans, ransomware, data breach., Online scams and frauds- email scams, Phishing, Vishing, Smishing, Online job fraud, Online sextortion, Debit/ credit card fraud, Online payment fraud, Cyberbullying, website defacement, Cyber- squatting, Pharming, Cyber espionage, Cryptojacking, Darknet - illegal trades, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft, job scams, misinformation, fake news, cyber crime against persons - cyber grooming, child pornography, cyber stalking., social Engineering attacks, Cyber Police stations, Crime reporting procedure, Case studies.

**UNIT III****CYBER LAW**

9

Cyber crime and legal landscape around the world, IT Act, 2000 and its amendments. Limitations of IT Act, 2000. Cyber crime and punishments, Cyber Laws and Legal and ethical aspects related to new technologies - AI/ML, IoT, Blockchain, Darknet and Social media, Cyber Laws of other countries, Case Studies.

**UNIT IV****DATA PRIVACY AND DATA SECURITY**

9

Defining data, meta-data, big data, non- personal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations(GDPR), 2016 Personal Information Protection and Electronic Documents Act (PIPEDA), Social media- data privacy and security issues.

**UNIT V****CYBER SECURITY MANAGEMENT, COMPLIANCE AND GOVERNANCE**

9

Cyber security Plan - cyber security policy, cyber crises management plan, Business continuity, Risk assessment, Types of security controls and their goals, cyber security audit and compliance, National cyber security policy and strategy.

**45 PERIODS****PRACTICAL EXERCISES:**

- 1 Platforms for reporting cyber crimes.
- 2 Checklist for reporting cyber crimes online.
- 3 Setting privacy settings on social media platforms.
- 4 Registering complaints on a Social media platform.
- 5 Prepare password policy for computer and mobile device.
- 6 List out security controls for computer and implement technical security controls in the personal computer.
- 7 List out security controls for mobile phone and implement technical security controls in the

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personal mobile phone.

- 8 Log into computer system as an administrator and check the security policies in the system.

**30 PERIODS**

**TOTAL: 75 PERIODS**

### REFERENCES:

- 1 Sumit Belapure, Nina Godbole, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", 1<sup>st</sup> Edition, Wiley India, 2011.
- 2 Dorothy Elizabeth Robling, "Information Warfare and Security", Addison Wesley Longman, 1999.
- 3 Henry A Oliver, "Security in the Digital Age: Social Media Security Threats and Vulnerabilities", Create Space Independent Publishing Platform, 2001.
- 4 Natraj Venkataramanan, Ashwin Shriram, "Data Privacy Principles and Practice", CRC Press, 2016.
- 5 Krag Brotby, "Information Security Governance, Guidance for Information Security Managers", 1<sup>st</sup> Edition, Wiley & Sons. 2009.
- 6 Martin Weiss, Michael G Solomon, "Auditing IT Infrastructures for Compliance", 2<sup>nd</sup> Edition, Jones & Bartlett Learning, 2016.
- 7 E Maiwald, "Fundamentals of Network Security", Tata McGraw Hill, 2017.

### ONLINE RESOURCES

- 1 <http://www.digimat.in/nptel/courses/video/106106212/L01.html>
- 2 [https://onlinecourses.swayam2.ac.in/cec24\\_cs03/preview](https://onlinecourses.swayam2.ac.in/cec24_cs03/preview)
- 3 [https://onlinecourses.swayam2.ac.in/cec24\\_cs01/preview](https://onlinecourses.swayam2.ac.in/cec24_cs01/preview)

### COURSE OUTCOMES:

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

- CO1 Explain the concepts of cyber security.
- CO2 Apply checklist for reporting cyber crimes online.
- CO3 Apply privacy settings on social media platforms
- CO4 Apply security controls for personal computer.
- CO5 Explain national cyber security policy and strategy.

### CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	-	-	-	1	1	1	-	1
CO2	3	2	1	2	2	-	-	1	1	1	-	1
CO3	3	2	1	2	2	-	-	1	1	1	-	1
CO4	3	2	1	2	2	-	-	1	1	1	-	1
CO5	2	2	1	2	2	-	-	1	1	1	-	1

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P23MC304

MACHINE LEARNING LABORATORY

L T P C

Prerequisites: Python Programming lab

0 0 3 1.5

COURSE OBJECTIVES:

- To implement popular machine learning algorithms using programming languages such as Python.
- To gain hands-on experience with popular machine learning libraries such as scikit-learn, TensorFlow etc.
- To apply machine learning techniques to real-world problems

LIST OF EXPERIMENTS:

- 1 Implement various data structuring techniques such as Data Binning, Data Sampling, Data Aggregation.
- 2 Applications of dimensionality reduction techniques on any dataset.
- 3 Implement data pre-processing techniques on real time dataset
- 4 Implement Feature subset selection techniques.
- 5 Implement Confusion matrix using sklearn and matplotlib.
- 6 Demonstrate how will you measure the performance of a machine learning model
- 7 Compute the accuracy of the naïve Bayesian classifier for a sample training data set.
- 8 Construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using the standard Heart Disease Data Set.
- 9 Apply EM algorithm to cluster a set of data stored in a .CSV file.
- 10 Write a program to implement k-Nearest Neighbour algorithm to classify the data set.
- 11 Classification of Email spam and MNIST data using Support Vector Machines.
- 12 Implement Logistic Regression to classify problems such as spam detection. Diabetes predictions and so on.

COURSE OUTCOMES:

TOTAL: 45 PERIODS

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

- C01 Apply data pre-processing technique.
- C02 Create and train a model and measure the performance.
- C03 Apply feature selection techniques in Machine Learning
- C04 Design Bayesian Network for appropriate problem
- C05 Write parametric and non-parametric machine Learning algorithms in practical situations

CO-PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	2	1	2	-	-	-	1	1	1	-	1	2	2
C02	3	3	3	3	-	-	-	1	1	1	-	1	2	2
C03	3	3	3	3	-	-	-	1	1	1	-	1	2	2
C04	3	3	3	3	-	-	-	1	1	1	-	1	2	2
C05	3	3	3	3	-	-	-	1	1	1	-	1	2	2

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**PROFESSIONAL ELECTIVES  
SEMESTER II, ELECTIVE I**

**P23MCEL01**

**SOFTWARE PROJECT MANAGEMENT**

L	T	P	C
3	0	0	3

**Prerequisites: Software Development**

**COURSE OBJECTIVES:**

- To know how to do project planning for the software process.
- To learn the cost estimation techniques during the analysis of the project.
- To understand the quality concepts for ensuring the functionality of the software.

**UNIT I**

**SOFTWARE PROJECT MANAGEMENT CONCEPTS**

9

Introduction to Software Project Management: An Overview of Project Planning: Select Project, Identifying Project scope and objectives, infrastructure, project products and Characteristics. Estimate efforts, Identify activity risks, and allocate resources- Six Sigma.

**UNIT II**

**SOFTWARE EVALUATION AND ESTIMATION TECHNIQUES**

9

Project Evaluation: Strategic Assessment, Technical Assessment, cost-benefit analysis, Cash flow forecasting, cost-benefit evaluation techniques. Selection of Appropriate Project approach: Choosing technologies, choice of process models, structured methods- Software Effort Estimation: Problems with over and under estimations, Basis of software Estimation, Software estimation techniques, expert Judgment, Estimating by analogy.

**UNIT III**

**STANDARDS, CERTIFICATIONS & ASSESSMENTS**

9

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

**UNIT IV**

**RISK MANAGEMENT**

9

Risk Management: Nature of Risk, Managing Risk, Risk Identification and Analysis, Reducing the Risk. Resource Allocation: Scheduling resources, Critical Paths, Cost scheduling, Monitoring and Control: Creating Framework, cost monitoring, prioritizing monitoring.

**UNIT V**

**GLOBALIZATION ISSUES IN PROJECT MANAGEMENT**

9

Globalization issues in project management: Evolution of globalization- challenges in building global teams-models for the execution of some effective management techniques for managing global teams. Impact of the internet on project management: Introduction – the effect of the internet on project management – managing projects for the internet – effect on project management activities. Comparison of project management software: dot Project, Launch pad, openProj.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Johannes W. P. G. Oosthuizen, "Software Project Management: A Process-Driven Approach" Springer, 2019

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- 2 Hugh Woodward "Software Project Management: A Unified Framework", 2<sup>nd</sup> Edition, Pearson Education, 2019

### REFERENCES:

- 1 Bob Hughes, Mike Cotterell & Rajib Mall "Software Project Management", 6<sup>th</sup> Edition, Tata McGraw Hill, 2017.
- 2 Ian Somerville, "Software Engineering", 10<sup>th</sup> Edition, Pearson Education, 2017.
- 3 Gopalaswamy Ramesh, "Managing Global Software Projects: How to Lead Geographically Distributed Teams, Manage Processes and Use Quality Models", Tata McGraw Hill, 2017.

### ONLINE RESOURCES:

- 1 <https://www.ibm.com/products/intelligent-promising/inventory-visibility>
- 2 <https://www.projectmanager.com/software>
- 3 <https://developer.android.com/>

### COURSE OUTCOMES:

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

- C01 Explain the project scheduling of any software application.
- C02 Explain the risk management activities and the resource allocation for the projects.
- C03 Apply the software estimation and recent quality standards for evaluation of the software projects.
- C04 Apply the skills needed for the construction of highly reliable software project.
- C05 Create reliable, replicable cost estimation of project planning and managing.

### CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C03	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C04	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C05	3	3	3	3	-	-	-	1	-	-	-	1	2	2

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P23MCEL02

PROFESSIONAL ETHICS IN IT

L T P C

Prerequisites: Ethical Issues in Computing

3 0 0 3

COURSE OBJECTIVES:

- To understand the concepts of computer ethics in the work environment.
- To understand the threats, intricacies of accessibility issues in computing environment.
- To understand the concepts of IPR, Social networking ethics and etiquettes.

UNIT I

INTRODUCTION TO ETHICS

9

Definition of Ethics- Right, Good, Just- The Rational Basis of Ethics -Theories of Right: Intuitionist vs. End-Based vs. Duty-Based -Rights, Duties, Obligations -Theory of Value Conflicting Principles and Priorities -The Importance of Integrity -The Difference Between Morals, Ethics, and Laws -Ethics in the Business World - Corporate Social Responsibility Creating an Ethical Work Environment -Including Ethical Considerations in Decision Making.

UNIT II

ETHICS IN INFORMATION TECHNOLOGY, INTERNET CRIME

9

IT Professionals - Are IT Workers Professionals- Professional Relationships That Must Be Managed -Professional Codes of Ethics - Professional Organizations - Certification - IT Professional Ethics, Three Codes of Ethics, Management Conflicts. The Reveton Ransomware Attacks -IT Security Incidents: A Major Concern - Why Computer Incidents Are So Prevalent -Types of Exploits -Types of Perpetrators-Federal Laws for Prosecuting Computer Attacks- Implementing Trustworthy Computing -Risk Assessment -Establishing a Security Policy Educating Employees and Contract Workers.

UNIT III

FREEDOM OF EXPRESSION, PRIVACY

9

First Amendment Rights -Obscene Speech-Defamation -Freedom of Expression: Key Issues Controlling Access to Information on the Internet -Strategic Lawsuit Against Public Participation (SLAPP)-Anonymity on the Internet-Hate Speech- Privacy Protection and the Law- Information Privacy- Privacy Laws, Applications, and Court Rulings-Key Privacy and Anonymity Issues- Data Breaches -Electronic Discovery-Consumer Profiling- Workplace Monitoring -Advanced Surveillance Technology.

UNIT IV

FREEDOM OF EXPRESSION, INTELLECTUAL PROPERTY RIGHTS

9

Intellectual Property Rights-Copyrights-Copyright Term - Eligible Works -Fair Use Doctrine Software Copyright Protection -Copyright Laws and the internet-Copyright and Piracy- Patents- -Software Patents -Cross-Licensing Agreements -Trade Secrets-Trade Secret Laws -Employees and Trade Secrets-Key Intellectual Property Issues-Plagiarism -Reverse Engineering-Open Source Code- Competitive Intelligence -Trademark Infringement -Cyber squatting.

UNIT V

SOCIAL NETWORKING ETHICS AND ETIQUETTES

9

Social Networking Web Site- Business Applications of Online Social Networking-Social Network Advertising-The Use of Social Networks in the Hiring Process-Social Networking Ethical Issues -Cyber bullying- Online Virtual Worlds-Crime in Virtual Worlds-Educational and Business Uses of Virtual Worlds.

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**TOTAL: 45 PERIODS**



### TEXT BOOKS:

- 1 George Reynolds, "Ethics in Information Technology", 6<sup>th</sup> Edition, Cengage Learning, 2022.
- 2 Sarah Gordon "Professional Ethics in Information Technology", 5<sup>th</sup> Edition, Cengage Learning, 2021.

### REFERENCES:

- 1 John Weckert and Douglas Adeney, "Computer and Information Ethics", 1<sup>st</sup> Edition, Greenwood Press, 2019.
- 2 Sara Baase, "A Gift of Fire: Social, Legal, and Ethical Issues for Computing Technology", 4<sup>th</sup> Edition, Pearson Education, 2018.
- 3 Raymond Panko and Sarah P. Williams, "Ethics in Information Technology", 6<sup>th</sup> Edition, Cengage Learning, 2018.

### ONLINE RESOURCES:

- 1 [https://onlinecourses.nptel.ac.in/noc22\\_mg54/](https://onlinecourses.nptel.ac.in/noc22_mg54/)
- 2 <https://www.acm.org/code-of-ethics>
- 3 <https://www.ethicsboard.org/>

### COURSE OUTCOMES:

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

- C01 Explain the basic concept of Ethics and its principles in businesses.
- C02 Describe about the code of ethics in the information technology and its security risk.
- C03 Summarize the key issues to access the information and its privacy.
- C04 Describe about Intellectual property rights and its safety.
- C05 Explain the use of social networking ethics in the educational and business sector.

### CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	2	-	-	-	-	2	2
C02	2	2	1	1	-	-	-	2	-	-	-	-	2	2
C03	2	2	1	1	-	-	-	2	-	-	-	-	2	2
C04	2	2	1	1	-	-	-	2	-	-	-	-	2	2
C05	2	2	1	1	-	-	-	2	-	-	-	-	2	2

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P23MCEL03

E - LEARNING

L T P C  
3 0 0 3

Prerequisites: Ethical Theories and Philosophies

**COURSE OBJECTIVES:**

- To learn the various E-learning approaches and Components.
- To understand the types of design models and Authoring tools of E-learning.
- To know about evaluation and management of E-learning solutions.

**UNIT I**

**INTRODUCTION**

9

Need for E-Learning – Approaches of E-Learning – Components of E-Learning –synchronous and Asynchronous Modes of Learning – Quality of E-Learning – Blended Learning: Activities, Team and Technology – Work Flow to Produce and Deliver E-Learning Content – Design Thinking: Introduction – Actionable Strategy – Act to Learn – Leading Teams to Win.

**UNIT II**

**DESIGNING E-LEARNING COURSE CONTENT**

9

Design Models of E-Learning – Identifying and Organizing E-Learning Course Content: Needs Analysis – Analyzing the Target Audience – Identifying Course Content – Defining Learning Objectives – Defining the Course Sequence – Defining Instructional Methods – Defining Evaluation and Delivery Strategies – Case Study.

**UNIT III**

**CREATING INTERACTIVE CONTENT**

9

Preparing Content: Tips for Content Development and Language Style – Creating Storyboards: Structure of an Interactive E-Lesson – Techniques for Presenting Content – Adding Examples – Integrating Multimedia Elements – Adding Examples – Developing Practice and Assessment Tests–Adding Additional Resources – Courseware Development Authoring Tools – Types of Authoring Tools – Selecting an Authoring Tool.

**UNIT IV**

**LEARNING PLATFORMS**

9

Types of Learning Platforms – Proprietary Vs. Open – Source LMS – LMS Vs LCMS – Internally Handled and Hosted LMS – LMS Solutions – Functional Areas of LMS.

**UNIT V**

**COURSE DELIVERY AND EVALUATION**

9

Components of an Instructor-Led or Facilitated Course – Planning and Documenting Activities – Facilitating Learners Activities – E-Learning Methods and Delivery Formats – Using Communication Tools for E-Learning – Course Evaluation.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Johnny Schneider, "Understanding Design Thinking, Lean and Agile", 1<sup>st</sup> Edition, O'Reilly Media, 2018.
- 2 Noor Zaman, "E-Learning: Concepts, Methodologies, Tools and Applications", 2<sup>nd</sup> Edition, Information Science Reference, 2018.

**REFERENCES:**

- 1 Vladimir L Uskov, Robert J Howlett, Lakhmi C Jain, "Smart Education and E-Learning",

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- 1<sup>st</sup> Edition, Springer, 2019.
- 2 Caroline Howard, "E-Learning: A Guidebook of Principles, Procedures and Practices", 2<sup>nd</sup> Edition, Routledge Publisher, 2017.
  - 3 Clark Quinn, "Millennials, Goldfish & Other Training Misconceptions: Debunking Learning Myths and Superstitions", 1<sup>st</sup> Edition, ATD Press, 2018.

#### ONLINE RESOURCES:

- 1 <https://business.udemy.com/request-demo-elearning>
- 2 <https://www.projectmanager.com/software>
- 3 <https://elearningindustry.com/8-inspiring-elearning-websites-offer-students-inspiring-educational-alternatives>

#### COURSE OUTCOMES:

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

- CO1 Summarize the phases of activities in models of E-learning.
- CO2 Apply the appropriate instructional methods and delivery strategies.
- CO3 Analyse E-learning Authoring tools.
- CO4 Create interactive E-learning platforms.
- CO5 Evaluate the E-learning courseware.

#### CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO2	3	2	1	2	-	-	-	1	-	-	-	1	2	2
CO3	3	3	2	2	-	-	-	1	-	-	-	1	2	2
CO4	3	3	3	3	-	-	-	1	-	-	-	1	2	2
CO5	3	3	2	3	-	-	-	1	-	-	-	1	2	2

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P23MCEL04

**SECURITY IN COMPUTING**

L T P C

**Prerequisites: Computer Networks**

3 0 0 3

**COURSE OBJECTIVES:**

- To understand the basics of cryptography and its vulnerabilities in programs.
- To know the different kinds of security threats in networks and databases and its solutions.
- To Learn about the models and standards for security.

**UNIT I**

**ELEMENTARY CRYPTOGRAPHY**

9

Terminology and Background – Substitution Ciphers – Transpositions – Making Good Encryption Algorithms- Data Encryption Standard- AES Encryption Algorithm – Public Key Encryption – Cryptographic Hash Functions – Key Exchange – Digital Signatures.

**UNIT II**

**PROGRAM SECURITY**

9

Secure programs – Non-malicious Program Errors – Viruses – Targeted Malicious code – Controls Against Program Threat – Control of Access to General Objects – User Authentication – Good Coding Practices – Open Web Application Security Project Flaws.

**UNIT III**

**SECURITY IN NETWORKS**

9

Threats in networks – Virtual Private Networks – PKI – SSL – IPsec – Content Integrity – Access Controls – Honeypots – Traffic Flow Security – Firewalls – Intrusion Detection Systems – Secure e-mail.

**UNIT IV**

**SECURITY IN DATABASES**

9

Security requirements of database systems – Reliability and Integrity in databases – Redundancy – Recovery – Concurrency/ Consistency – Monitors – Sensitive Data – Types of disclosures – Inference-finding and confirming sql injection.

**UNIT V**

**SECURITY MODELS AND STANDARDS**

9

Secure SDLC – Security architecture models – Bell-La Padula Confidentiality Model – Biba Integrity Model – Graham-Denning Access Control Model – Harrison-Ruzzo-Ulman Model – Secure Frameworks – COSO – CobiT – Security Standards - ISO 27000 family of standards – NIST.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", 5<sup>th</sup> Edition, Pearson Education, 2018
- 2 Michael Whitman, Herbert J. Mattord, "Management of Information Security", 6<sup>th</sup> Edition, Course Technology, 2018.

**REFERENCES:**

- 1 William Stallings, "Cryptography and Network Security: Principles and Practices", 8<sup>th</sup> Edition, Prentice Hall, 2021.
- 2 Matt Bishop, "Computer Security: Art and Science", 2<sup>nd</sup> Edition, Addison- Wesley, 2018.
- 3 Charles P. Pfleeger, Shari Lawrence Pfleeger, and Jonathan Margulies, "Security in Computing", 6<sup>th</sup> Edition, Pearson Education, 2018.

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**ONLINE RESOURCES:**

- 1 [https:// business.udemy.com/ request-demo-elearning](https://business.udemy.com/request-demo-elearning)
- 2 [https://www. projectmanager.com/software](https://www.projectmanager.com/software)
- 3 <https://elearningindustry.com/8-inspiring-elearning-websites-offer-students-inspiring-educational-alternatives>

**COURSE OUTCOMES:**

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

- C01** Understand the basic of cryptographic algorithms for encrypting and decryption for secure data transmission.
- C02** Analyze the importance of Digital signature for secure e-documents exchange.
- C03** Explain the program threats and apply good programming practice.
- C04** Describe about the security services available for internet and web applications.
- C05** Summarize data vulnerability and sql injection.

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>C01</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2
<b>C02</b>	3	3	2	2	-	-	-	1	-	-	-	1	2	2
<b>C03</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2
<b>C04</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2
<b>C05</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2

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P23MCEL05

## INFORMATION RETRIEVAL TECHNIQUES

L T P C

Prerequisites: Understanding of text processing

3 0 0 3

### COURSE OBJECTIVES:

- To understand the basics of information retrieval with pertinence to modeling, query operations and indexing.
- To get an understanding of machine learning techniques for text classification and clustering.
- To understand the various applications of information retrieval giving emphasis to multimedia IR, web search.

### UNIT I

#### INTRODUCTION

9

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

### UNIT II

#### MODELING

9

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

### UNIT III

#### INDEXING

9

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

### UNIT IV

#### CLASSIFICATION AND CLUSTERING

9

Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering – Matrix decompositions and latent semantic indexing – Fusion and Meta learning.

### UNIT V

#### SEARCHING THE WEB AND RETRIEVAL

9

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

**TOTAL: 45 PERIODS**

### TEXT BOOKS:

- 1 Stefan Büttcher, Charles L A Clarke, Gordon V Cormack, "Information Retrieval: Implementing and Evaluating Search Engines", 2<sup>nd</sup> Edition, MIT Press, 2020
- 2 Christopher D Manning, Prabhakar Raghavan, Hinrich Schütze, and Stefan Büttcher, "Introduction to Information Retrieval", 2<sup>nd</sup> Edition, Cambridge University Press, 2021.

### REFERENCES:

- 1 Iresh A Dhotre "Introduction to Information Retrieval", 2<sup>nd</sup> Edition, Technical Publications, 2021.

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- 2 Massachusetts, "Implementing and Evaluating Search Engines", 2<sup>nd</sup> Edition, The MIT Press, 2021.

**ONLINE RESOURCES:**

- 1 [https:// www.researchgate.net /242403883\\_Information\\_Retrieval\\_Techniques](https://www.researchgate.net/242403883_Information_Retrieval_Techniques)  
 2 [https://www.upgrad.com /information-retrieval-system-explained/](https://www.upgrad.com/information-retrieval-system-explained/)  
 3 [https:// www.udemy.com course/information-retrieval-and-mining-massive-data- sets/](https://www.udemy.com/course/information-retrieval-and-mining-massive-data-sets/)

**COURSE OUTCOMES:**

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

- C01** Apply Information Retrieval system using the available tools.  
**C02** Analyze the various components of an Information Retrieval system.  
**C03** Evaluate the Models of an information retrieval system.  
**C04** Apply machine learning techniques to text classification and clustering.  
**C05** Design an efficient search engine and analyze the Web content structure.

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>C01</b>	3	2	1	2	-	-	-	1	-	-	-	1	2	2
<b>C02</b>	3	3	2	2	-	-	-	1	-	-	-	1	2	2
<b>C03</b>	3	3	2	3	-	-	-	1	-	-	-	1	2	2
<b>C04</b>	3	2	1	2	-	-	-	1	-	-	-	1	2	2
<b>C05</b>	3	3	3	3	-	-	-	1	-	-	-	1	2	2

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P23MCEL06

SOFT COMPUTING TECHNIQUES

L T P C

Prerequisites: Fuzzy Logic

3 0 0 3

**COURSE OBJECTIVES:**

- To design a soft computing system required to address a computational task.
- To learn and apply artificial neural networks, fuzzy sets and fuzzy logic and genetic algorithms in problem solving and use of heuristics based on human experience.
- To familiarize with genetic algorithms and other random search procedures while seeking global optimum in self – learning situations.

**UNIT I FUNDAMENTALS OF NEURAL NETWORKS 9**

Neuron, Nerve Structure and Synapse, Artificial Neuron and its Model, Activation Functions, Neural Network Architecture: Single Layer and Multilayer Feed Forward Networks, Recurrent Networks. Various Learning Techniques; Perception and Convergence Rule, Auto-Associative and Hetero-Associative Memory.

**UNIT II BACKPROPAGATION NETWORKS 9**

Back Propagation Networks) Architecture: Perceptron Model, Solution, Single Layer Artificial Neural Network, Multilayer Perceptron Model; Back Propagation Learning Methods, Effect of Learning Rule Co – Efficient ; Back Propagation Algorithm, Factors Affecting Backpropagation Training, Applications.

**UNIT III COMPETITIVE NEURAL NETWORKS 9**

Kohonen's Self Organizing Map – SOM Architecture, learning procedure – Application; Learning Vector Quantization – learning by LVQ; Adaptive Resonance Theory – Learning procedure – Applications.

**UNIT IV FUZZY COMPUTING 9**

Basic Concepts of Fuzzy Logic, Fuzzy Sets and Crisp Sets, Fuzzy Set Theory and Operations, Properties of Fuzzy Sets, Fuzzy and Crisp Relations, Fuzzy to Crisp Conversion Membership Functions, Inference in Fuzzy Logic, Fuzzy If – Then Rules, Fuzzy Implications and Fuzzy Algorithms, Fuzzification and Defuzzification, Fuzzy Controller, Industrial Applications.

**UNIT V GENETIC ALGORITHM 9**

Basic Concepts, Working Principle, Procedures of GA, Flow Chart of GA, Genetic Representations, (Encoding) Initialization and Selection, Genetic Operators, Mutation, Generational Cycle, Applications .

**TEXT BOOKS: TOTAL: 45 PERIODS**

- 1 S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, Fuzzy Systems and Evolutionary Algorithms: Synthesis and Applications", 2<sup>nd</sup> Edition, Prentice Hall of India, 2013.
- 2 Kannad Ray, Millie Pant, Anirban Bandyopadhyaya, "Soft Computing Applications", Springer, 2018.

**REFERENCES:**

- 1 S N Sivanandam, S. N. Deepa, "Principles of Soft Computing", 3<sup>rd</sup> Edition, Wiley, 2018.

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- 2 Timothy Ross, "Fuzzy Logic with Engineering Applications", 4<sup>th</sup> Edition, Wiley & Sons, 2017.
- 3 Amit Konar, "Artificial Intelligence and Soft Computing: Behavioral and Cognitive Modeling of the Human Brain", 1<sup>st</sup> Edition, CRC Press, 2017.

**ONLINE RESOURCES:**

- 1 [https://onlinecourses.nptel.ac.in/noc22\\_cs54/](https://onlinecourses.nptel.ac.in/noc22_cs54/)
- 2 [https://www.ncerc.ac.in/+course+website&sca\\_esv=9e96d3fc373d3ae1/](https://www.ncerc.ac.in/+course+website&sca_esv=9e96d3fc373d3ae1/)
- 3 <https://www.udemy.com/course/machinelearning/>

**COURSE OUTCOMES:**

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

- CO1** Describe soft computing techniques and their roles in building intelligent machines.
- CO2** Apply a soft computing methodology for a particular problem.
- CO3** Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- CO4** Analyze genetic algorithms to optimization problems
- CO5** Design neural networks to pattern classification and regression problems using a soft computing approach.

**CO-PO-PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO2	3	2	1	2	-	-	-	1	-	-	-	1	2	2
CO3	3	2	1	2	-	-	-	1	-	-	-	1	2	2
CO4	3	3	2	2	-	-	-	1	-	-	-	1	2	2
CO5	3	3	3	3	-	-	-	1	-	-	-	1	2	2

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P23MCEL07

## AD-HOC AND SENSOR NETWORKS

L T P C  
3 0 0 3

Prerequisites: Computer Networks

### COURSE OBJECTIVES:

- To understand the basics of Ad-hoc & Sensor Networks.
- To learn various fundamental and emerging protocols of all layers in ad-hoc network.
- To study about the issues pertaining to major obstacles in establishment and efficient management of ad-hoc and sensor networks.

### UNIT I

#### ADHOC NETWORKS FUNDAMENTALS & COMMUNICATION PROTOCOLS

9

Fundamentals Of WLANs - IEEE 802.11 Architecture - Self Configuration and Auto Configuration-issues in Ad-Hoc Wireless Networks - MAC Protocols for Ad-Hoc Wireless Networks - Contention Based Protocols - TCP Over Ad-Hoc Networks-TCP Protocol Overview - TCP and MANETs - Solutions for TCP Over Ad-Hoc Networks.

### UNIT II

#### ADHOC NETWORK ROUTING AND MANAGEMENT

9

Routing in Ad-Hoc Networks- Introduction -Topology based versus Position based Approaches - Proactive Routing - DSDV, WRP, TBRPF Reactive Routing - DSR,AODV, Hybrid Routing Approach ZRP, CBRP- Location services - DREAM - Quorums based Location Service - Forwarding Strategies - Greedy Packet Forwarding, LAR.

### UNIT III

#### SENSOR NETWORK COMMUNICATION PROTOCOLS

9

Introduction - Architecture - Single Node Architecture - Sensor Network Design Considerations - Energy Efficient Design Principles for WSN's - Protocols for WSN - Physical Layer - Transceiver Design Considerations - MAC Protocols for wireless sensor network - IEEE 802.15.4 Zigbee - Link Layer and Error Control Issues - Routing Protocols - Gossiping and agent based unicast forwarding, Energy efficient unicast -Transport Protocols & QoS - Congestion Control Issues - Application specific Support - Target detection and tracking.

### UNIT IV

#### SENSOR NETWORK MANAGEMENT AND PROGRAMMING

9

Sensor Management - Topology Control Protocols and Sensing Mode Selection Protocols - Time Synchronization - Localization and Positioning - Operating Systems and Sensor Network Programming - Sensor Network Simulators- Case study: Industrial automation and tsunami early warning system with wireless sensor networks.

### UNIT V

#### ADHOC AND SENSOR NETWORK SECURITY

9

Security in Ad-Hoc and Sensor Networks - Key Distribution and Management - Software based Anti-tamper Techniques - Water Marking techniques - Defense against Routing Attacks - Secure Adhoc Routing Protocols - Broadcast Authentication WSN Protocols - TESLA - Biba - Sensor Network Security Protocols - SPINS.

### TEXT BOOKS:

TOTAL: 45 PERIODS

- 1 Mohammad S Obaidat, Sudip Misra, Sabu M Thampi, "Ad Hoc and Sensor Networks: Theory and Applications" 2nd Edition Cambridge University Press 2020

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- 2 Subir Kumar Sarkar, T G Basavaraju, "Ad Hoc and Sensor Networks: A Cross-Layer Design Perspective", 1<sup>st</sup> Edition, CRC Press, 2021.

**REFERENCES:**

- 1 Sajal K. Das, and Anup Kumar, "Ad Hoc and Sensor Networks: Wireless, Mobile, and Sensor Networks", 2<sup>nd</sup> Edition, Springer, 2017.
- 2 Carlos de Moraes Cordeiro, Dharma P Agrawal, "Ad Hoc and Sensor Networks: Theory and Applications", 2<sup>nd</sup> Edition, World Scientific Publishing, 2017.
- 3 Hossam Hassanein, Al-Sakib Khan Pathan, "Ad Hoc and Sensor Networks: Theory and Practice", 1<sup>st</sup> Edition, Cambridge University Press, 2018.

**ONLINE RESOURCES:**

- 1 [https:// archive.nptel.ac.in,/k;/106/105/106105160/](https://archive.nptel.ac.in,/k;/106/105/106105160/)
- 2 <https://ieeexplore.ieee.org/ document/1249521/>
- 3 <https://www.udemy.com/course/wireless-sensor-networks-electronics-telecommunication-f/>

**COURSE OUTCOMES:**

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

- C01** Create a Sensor network environment for different type of applications.
- C02** Design ad-hoc and sensor network architectures using QoS and Congestion control mechanisms.
- C03** Analyze the various control fields of the protocol in each layer.
- C04** Apply appropriate routing algorithms for different network environments.
- C05** Analyze security mechanisms in the wireless ad-hoc and sensor networks.

**CO-PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>C01</b>	3	3	3	3	-	-	-	1	-	-	-	1	2	2
<b>C02</b>	3	3	3	3	-	-	-	1	-	-	-	1	2	2
<b>C03</b>	3	3	2	2	-	-	-	1	-	-	-	1	2	2
<b>C04</b>	3	2	1	2	-	-	-	1	-	-	-	1	2	2
<b>C05</b>	3	3	2	2	-	-	-	1	-	-	-	1	2	2

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P23MCEL08

## BUSINESS DATA ANALYTICS

L T P C  
3 0 0 3

Prerequisites: Data Mining

### COURSE OBJECTIVES:

- To gain knowledge about fundamental business analytics.
- To learn modeling for uncertainty and statistical inference.
- To understand analytics using Hadoop and Map Reduce frameworks.

#### UNIT I

#### OVERVIEW OF BUSINESS ANALYTICS

9

Introduction - Drivers for Business Analytics - Applications of Business Analytics: Marketing and Sales, Human Resource, Healthcare, Product Design, Service Design, Customer Service and Support - Skills Required for a Business Analyst - Framework for Business Analytics Life Cycle for Business Analytics Process.

#### UNIT II

#### ESSENTIALS OF BUSINESS ANALYTICS

9

Descriptive Statistics - Using Data - Types of Data - Data Distribution Metrics: Frequency, Mean, Median, Mode, Range, Variance, Standard Deviation, Percentile, Quartile, z-Score, Covariance, Correlation - Data Visualization: Tables, Charts, Line Charts, Bar and Column Chart, Bubble Chart, Heat Map - Data Dashboards.

#### UNIT III

#### MODELING UNCERTAINTY AND STATISTICAL INFERENCE

9

Modeling Uncertainty: Events and Probabilities - Conditional Probability - Random Variables - Discrete Probability Distributions - Continuous Probability Distribution - Statistical Inference: Data Sampling - Selecting a Sample - Point Estimation - Sampling Distributions - Interval Estimation - Hypothesis Testing.

#### UNIT IV

#### ANALYTICS USING HADOOP AND MAPREDUCE FRAMEWORK

9

Introducing Hadoop - RDBMS versus Hadoop - Hadoop Overview - HDFS (Hadoop Distributed File System) - Processing Data with Hadoop - Introduction to MapReduce - Features of MapReduce - Algorithms Using Map-Reduce: Matrix-Vector Multiplication, Relational Algebra Operations, Grouping and Aggregation - Extensions to MapReduce.

#### UNIT V

#### OTHER DATA ANALYTICAL FRAMEWORKS

9

Overview of Application development Languages for Hadoop - PigLatin - Hive - Hive Query Language (HQL) - Introduction to Pentaho, JAQL - Introduction to Apache: Sqoop, Drill and Spark, Cloudera Impala - Introduction to NoSQL Databases - Hbase and MongoDB.

**TOTAL: 45 PERIODS**

#### TEXT BOOKS:

- 1 U. Dinesh Kumar, "Business Analytics: The Science of Data-Driven Decision Making", 1<sup>st</sup> Edition, John Wiley & Sons, 2021.
- 2 Jeffrey D Camm, James J Cochran, Michael J Fry, Jeffrey W Ohlmann, David R Anderson, "Essentials of Business Analytics", 2<sup>nd</sup> Edition, Cengage Learning, 2023.

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## REFERENCES:

- 1 Anand Rajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", 1<sup>st</sup> Edition, Cambridge University Press, 2021.
- 2 Umesh R Hodeghatta, Umesha Nayak, "Business Analytics Using R – A Practical Approach", 1<sup>st</sup> Edition, Apress, 2020.
- 3 Albright, S. C., Winston, W. L., & Zappe, C., "Business Analytics: Data Analysis & Decision Making", 6<sup>th</sup> Edition, Cengage Learning, 2019.

## ONLINE RESOURCES:

- 1 <https://www.udemy.com/analytics-and-intelligence/>
- 2 <https://www.guvi.in/zen-class/data-science-course/>
- 3 [https://excelr.in/data\\_analyst\\_course/](https://excelr.in/data_analyst_course/)

## COURSE OUTCOMES:

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

- CO1 Analyze the real world business problems and model with analytical solutions.
- CO2 Analyze the analytical problems with relevant mathematics background knowledge.
- CO3 Apply suitable statistical testing for real world decision making problem.
- CO4 Create simple applications involving analytics using Hadoop and MapReduce.
- CO5 Apply open source frameworks for modeling and storing data.

## CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	1	-	-	-	1	2	2
CO2	3	3	2	2	-	-	-	1	-	-	-	1	2	2
CO3	3	2	1	1	-	-	-	1	-	-	-	1	2	2
CO4	3	3	3	3	-	-	-	1	-	-	-	1	2	2
CO5	3	2	1	2	-	-	-	1	-	-	-	1	2	2

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**PROFESSIONAL ELECTIVES  
SEMESTER III, ELECTIVE II**

**P23MCEL09**

**INTERNET OF THINGS**

**Prerequisites: Embedded Systems**

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**COURSE OBJECTIVES:**

- To understand the concepts of IoT and its working models
- To know the various IoT protocols
- To understand about various IoT Physical devices and Endpoints

**UNIT I**

**FUNDAMENTALS OF IOT**

9

Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

**UNIT II**

**IOT PROTOCOLS**

9

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security

**UNIT III**

**IOT PHYSICAL DEVICES AND ENDPOINTS**

9

Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, and reading input from pins

**UNIT IV**

**INTERNET OF THINGS PRIVACY, SECURITY AND GOVERNANCE**

9

Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.

**UNIT V**

**CASE STUDIES**

9

IOT APPLICATIONS - IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley & Sons, 2018.
- 2 Rajkumar Buyya, Amir Vahid Dastjerdi, and Pethuru Raj, "Internet of Things: Principles and Paradigms", 2<sup>nd</sup> Edition, Morgan Kaufmann, 2020.

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## REFERENCES:

- 1 Monk, O'Reilly, "Raspberry Pi Cookbook, Software and Hardware Problems and solutions", Simon SPD, 2023.
- 2 David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals, Networking Technologies, Protocols, and Use cases for the Internet of Things", 1<sup>st</sup> Edition, Cisco Press, 2017.
- 3 Marco Zennaro, Vincenzo Vittorini, Nicola Capodieci, "Internet of Things: Architectures, Protocols and Standards", 1<sup>st</sup> Edition, Springer, 2017.

## ONLINE RESOURCES:

- 1 <https://www.edx.org/learn/iot-internet-of-things>
- 2 <https://www.netacad.com/courses/iot>
- 3 [https://www.nptel.ac.in/com/noc22\\_cs53/](https://www.nptel.ac.in/com/noc22_cs53/)

## COURSE OUTCOMES:

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

- CO1 Explain the IoT Communication models and Protocols.
- CO2 Apply the IoT protocols for communication between various IoT devices.
- CO3 Design portable IoT using Arduino/Raspberry Pi /equivalent boards.
- CO4 Summarize the basic concepts of security and governance as applied to IoT.
- CO5 Analyze the applications of IoT in real time scenarios.

## CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	1	-	-	1	-	-	-	1	2	2
CO2	3	2	1	2	1	-	-	1	-	-	-	1	2	2
CO3	3	3	3	3	1	-	-	1	-	-	-	1	2	2
CO4	2	2	1	1	1	-	-	1	-	-	-	1	2	2
CO5	3	3	2	2	1	-	-	1	-	-	-	1	2	2

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**P23MCEL10**

**DIGITAL IMAGE PROCESSING**

**L T P C**

**Prerequisites: Digital Image Fundamentals**

**3 0 0 3**

**COURSE OBJECTIVES:**

- To learn digital image fundamentals.
- To learn image enhancement in the spatial and frequency
- To know image segmentation and compression techniques

**UNIT I**

**DIGITAL IMAGE FUNDAMENTALS**

**9**

Elements of visual perception, Image Acquisition Systems, Sampling and Quantization, Image Formation, Image Geometry, Different types of digital images. Relationship between pixels, Basic concepts of distance transform, Color Image fundamentals-RGB-HIS Models, Different color models-conversion.

**UNIT II**

**IMAGE TRANSFORMS**

**9**

1D Discrete Fourier Transform (DFT), 2D transforms – DFT, Discrete Cosine Transform, Walsh and PCA

**UNIT III**

**IMAGE ENHANCEMENT**

**9**

Gray Level transformations, Histogram Equalization, Spatial Domain: Basics of Spatial Filtering: smoothing and sharpening spatial filters. Frequency domain: smoothing and sharpening frequency domain filters, Ideal, Gaussian filters.

**UNIT IV**

**IMAGE SEGMENTATION AND FEATURE EXTRACTION**

**9**

Segmentation: Point detection, line detection, edge detection, Region based segmentation, Region Splitting and Merging Technique. Thresholding Techniques: multilevel thresholding, optimal thresholding using Bayesian classification. Feature Extraction: GLCM, Hough Transform, 61 Morphological operation.

**UNIT V**

**IMAGE COMPRESSION**

**9**

Lossy and lossless compression schemes, prediction based compression schemes, sub-band encoding schemes, JPEG compression standard, Fractal compression scheme, Wavelet compression scheme

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Rafael C Gonzalez and Richard E Woods, "Digital Image Processing", 4<sup>th</sup> Edition, Pearson Education, 2018.
- 2 S. Jayaraman, S. Esakkirajan, and T. Veerakumar, "Digital Image Processing", 3<sup>rd</sup> Edition, McGraw Hill, 2017.

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## REFERENCES:

- 1 Kenneth R. Castleman, "Digital Image Processing", 1<sup>st</sup> Edition, Prentice Hall of India, 2020.
- 2 John C. Russ, "The Image Processing Handbook", 5<sup>th</sup> Edition, Prentice Hall of India, 2018.
- 3 Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing Using MATLAB", 3<sup>rd</sup> Edition, Gatesmark Publishing, 2018.

## ONLINE RESOURCES:

- 1 <https://www.imageprocessingplace.com>
- 2 <https://www.ipol.im>
- 3 <https://imagemagick.org>

## COURSE OUTCOMES:

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

- CO1 Explain the fundamentals of Image processing concepts.
- CO2 Apply the image Transformation techniques to various domains.
- CO3 Explain the image Enhancement techniques in spatial domain for visual representation.
- CO4 Summarize the image segmentation and feature extraction techniques.
- CO5 Analyze the different image compression techniques and its significance.

## CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO2	3	2	1	2	-	-	-	1	-	-	-	1	2	2
CO3	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO4	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO5	3	3	2	2	-	-	-	1	-	-	-	1	2	2

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P23MCEL11

**WEB AND SOCIAL NETWORK ANALYTICS**

**L T P C**

**Prerequisites: Data Structures and Algorithms**

**3 0 0 3**

**COURSE OBJECTIVES:**

- To know about social networks, its structure and their data sources.
- To analyze the data left behind in social networks.
- To gain knowledge about the community-maintained social media resources.

**UNIT I**

**INTRODUCTION TO SEMANTIC WEB**

**9**

The development of Semantic Web – Emergence of the Social Web – The Development of Social Network Analysis – Basic Graph Theoretical Concepts of Social Network Analysis – Electronic Sources for Network Analysis – Electronic Discussion Networks, Blogs and Online Communities

**UNIT II**

**KNOWLEDGE REPRESENTATION ON THE SEMANTIC WEB**

**9**

Ontology-based knowledge Representation – Ontology languages for the Semantic Web: RDF and OWL

**UNIT III**

**SOCIAL NETWORK MINING**

**9**

Detecting Communities in Social Network – Evaluating Communities – Methods for Community Detection – Applications of Community Mining Algorithms – Tools for detecting communities – Application: Mining Facebook

**UNIT IV**

**COMMUNITY MAINTAINED SOCIAL MEDIA RESOURCES**

**9**

Community Maintained Resources – Supporting technologies for community maintained resources– User motivations–Location based social interaction – location technology– mobile location sharing – Automated recommender system

**UNIT V**

**VISUALIZATION OF SOCIAL NETWORKS**

**9**

Visualization of Social Networks - Node-Edge Diagrams – Random Layout – Force-Directed Layout – Tree Layout – Matrix Representations – Matrix and Node-Link Diagrams– Visualizing Online Social Networks

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Jiawei Han, Michalis Vazirgiannis, Diane J. Cook, "Web and Social Network Analytics: Multimodal and Multiscale Approaches", 1st Edition, Springer, 2018.
- 2 Emilio Ferrara, "Web and Social Network Analytics: A Data-Driven Approach", 1st Edition, Chapman and Hall/CRC, 2019.

**REFERENCES:**

- 1 Katarzyna Hano, "Jury Decision Making and Social Network Analysis", VDM Verlag Dr. Mueller E.K., 2021.
- 2 Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2017.
- 3 Abbasi, H Chen, L Haque, K Liu, "Social Network Data Analytics", 1st Edition, Springer, 2017

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### ONLINE RESOURCES:

- 1 [https:// www.coursera.org/courses?query=social%20media%20analytics](https://www.coursera.org/courses?query=social%20media%20analytics)
- 2 [https:// www.quintly.com](https://www.quintly.com)
- 3 [https:// buffer.com/library/social-media-analytics-tools/](https://buffer.com/library/social-media-analytics-tools/)

### COURSE OUTCOMES:

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

- C01 Create entities and relationships of data.
- C02 Explain the model of social semantic Web.
- C03 Apply mining tools for analyzing Social networks.
- C04 Analyze data from various social media resources.
- C05 Explain personalized visualization for Social networks.

### CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	3	3	-	-	-	1	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C03	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C04	3	3	2	2	-	-	-	1	-	-	-	1	2	2
C05	2	2	1	1	-	-	-	1	-	-	-	1	2	2

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P23MCEL12

**DIGITAL MARKETING**

**L T P C**

**Prerequisites: Marketing Fundamentals**

**3 0 0 3**

**COURSE OBJECTIVES:**

- To know about Traditional Marketing and Digital Marketing
- To identify the issues in drafting a digital marketing plan
- To develop Digital marketing platforms and the theoretical aspects of creating a website

**UNIT I**

**INTRODUCTION TO DIGITAL MARKETING**

**9**

What is Digital Marketing- Need of Digital Marketing-Digital Marketing Platforms - Understanding digital marketing process- Difference between Traditional Marketing and digital Marketing- tools of Digital marketing - Advantage of Digital Marketing-Digital Marketing Manager Role and functions - How we use both Digital & Traditional Marketing

**UNIT II**

**WEBSITE AND SEARCH ENGINE**

**9**

Website -Hosting and Domain- Different platforms for website creation- Introduction to SERP- What are search engines- How search engines work- Major functions of a search engine- What are keywords -Different types of keywords- Google keyword planner tool.

**UNIT III**

**MISC TOOLS- GOOGLE WEBMASTER TOOLS**

**9**

Site Map Creators- Browser-based analysis tools-Page Rank tools-pinging & indexing tools- Dead links identification tools- Open site explorer Domain information/ whois tools- Quick sprout

**UNIT IV**

**LEAD MANAGEMENT AND DIGITAL MARKETING**

**9**

Web to lead forms- Web to case forms- Lead generation techniques- Leads are everywhere Social media and lead gen Inbuilt tools for Digital Marketing-Ip Tracker- CPC reduction (in case of paid ads) Group posting on Social Media platforms

**UNIT V**

**TRENDING DIGITAL MARKETING SKILLS**

**9**

Search Engine Optimization (SEO)-Search Engine Marketing (SEM).-Social Media Marketing/Optimization- Email Marketing. Website: Product Marketing- Content Writing. Marketing 68 the created content online Copywriting- Blogging- Local Marketing. Google Ad Words - Campaign Management- PPC Advertising- Affiliate Marketing. Mobile and SMS Marketing- Marketing Automation-Web Analytics- Growth Hacking

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Dave Chaffey and Fiona Ellis-Chadwick, "Digital Marketing: Strategy, Implementation and Practice", 6<sup>th</sup> Edition, Pearson Education, 2019.
- 2 Chaffey, D., & Smith, P. R, "Digital marketing excellence: planning, optimizing and integrating online marketing" Taylor & Francis, 2017.

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## REFERENCES:

- 1 Chaffey D, "Digital marketing strategy, Implementation and Practice" Pearson Education, 2019.
- 2 Mary Lou Roberts, Debra Zahay, "Digital Marketing: Global Strategies from the World's Leading Experts", 1<sup>st</sup> Edition, CreateSpace Independent Publishing Platform, 2017.
- 3 Philip Kotler, Hermawan Kartajaya, Iwan Setiawan, "Marketing 4.0: Moving from Traditional to Digital", 1<sup>st</sup> Edition, Wiley & Sons, 2017.

## ONLINE RESOURCES:

- 1 <https://online-em.isb.educourses/digital-marketing-and-analytics>
- 2 <https://www.udemy.com/courses/marketing/digital-marketing/>
- 3 <https://www.futurelearn.com/subjects/business-and-management-courses/digital-marketing>

## COURSE OUTCOMES:

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

- CO1 Analyze the confluence of marketing, operations, and human resources.
- CO2 Explain the cognitive knowledge of the skills required in conducting online research.
- CO3 Evaluate issues in adapting to globalized markets.
- CO4 Explain the range of digital strategies and tactics.
- CO5 Summarize cross-cultural and ethical issues in globalized digital markets.

## CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	1	-	-	-	1	2	2
CO2	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO3	3	3	2	3	-	-	-	1	-	-	-	1	2	2
CO4	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO5	2	2	1	1	-	-	-	1	-	-	-	1	2	2

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P23MCEL13

ADVANCES IN NETWORKING

L T P C

Prerequisites: Computer Networks

3 0 0 3

COURSE OBJECTIVES:

- To understand the theme underlying IPv6 Structure and addressing methods
- To understand and analyze the protocols for IPv6 Implementation
- To identify and provide solutions for QoS and Security Issues with IPv6

UNIT I

IPv6 STRUCTURE AND ADDRESSING

9

IPv4 Address Depletion- IPv6 Transition Issues-IPv6 Structure: IPv6 Header, Extension Headers: 59 Hop-by-Hop Options Header, Destination Options Header, Routing Header, Fragment Header, AH, ESP- IPv6 Addresses: Unicast, Anycast, Multicast - Address Auto configuration

UNIT II

IPv6 NETWORKING

9

IPv6 Internet Control Message Protocol (ICMPv6): ICMPv6 Messages, Fragmentation and Path MTU- IPv6 Neighbor Discovery- IPv6 Routing : RIPng, EIGRP for IPv6, OSPFv3 - Mobile IPv6

UNIT III

QoS, PROVISIONING AND SECURITY WITH IPv6

9

QoS in IPv6 Protocols: Differentiated Services and IPv6, IPv6 Flows, Explicit Congestion Notification in IPv6 - Provisioning: Stateless DHCPv6, Stateful DHCPv6, DNS Extensions for IPv6- Security with IPv6: IP Security Protocol (IPsec) Basics, IPv6 Security Elements, Interaction of IPsec with IPv6 Elements

UNIT IV

SOFTWARE DEFINED NETWORKING

9

Genesis of SDN - Separation of Control Plane and Data Plane - Distributed Control Plane -IP and MPLS - Characteristics of SDN - Operation - Devices - Controller - OpenFlow Specification

UNIT V

NETWORK FUNCTION VIRTUALIZATION

9

Building SDN Framework - Network Functions Virtualization - Introduction -Virtualization and Data Plane I/O - Service Locations and Chaining - Applications - Use Cases of SDNs: Data Centers, Overlays, Big Data and Network Function Virtualization

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Rick Graziani, "IPv6 Fundamentals: A Straightforward Approach to Understanding IPv6" 2<sup>nd</sup> Edition, Cisco Press, 2017.
- 2 Jun Zheng, Xuemin (Sherman) Shen, Athanasios V. Vasilakos, "Network Coding: Fundamentals and Applications", 2<sup>nd</sup> Edition, Academic Press of Elsevier, 2021.

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## REFERENCES:

- 1 William Stallings, "Foundations of Modern Networking – SDN, NFC, QoE, IoT and Cloud", 3<sup>rd</sup> Edition, Pearson Education, 2019.
- 2 Oswald Coker, Siamak Azodolmolky, "Software-Defined Networking with OpenFlow", 2<sup>nd</sup> Edition, Packt Publishing, 2017.

## ONLINE RESOURCES:

- 1 <https://www.edx.org/learn/gis-geographic-information-systems>
- 2 <https://www.alison.com/geographic-information-systems>
- 3 [https://www.nptel.ac.in/noc23\\_cs35](https://www.nptel.ac.in/noc23_cs35)

## COURSE OUTCOMES:

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

- C01 Describe IPv6 Structure and addressing methods.
- C02 Apply the strategies for deploying IPv6 in the place of IPv4.
- C03 Analyze the security issues for IPv6 in emerging applications.
- C04 Summarize the need for separation of data and control plane in Networking.
- C05 Apply SDN to enable and enhance NFV

## CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C03	3	3	2	2	-	-	-	1	-	-	-	1	2	2
C04	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C05	3	2	1	2	-	-	-	1	-	-	-	1	2	2

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## REFERENCES:

- 1 Magwire D J, Goodchild M F, Rhind, D M, "Geographical Information Systems: Principles and Applications", 6<sup>th</sup> Edition, Longman Group, 2021.
- 2 Kang-tsung Chang, 'Introduction to Geographic Information Systems' Tata McGraw Hill, 2020.
- 3 Jonathan P Howarth, "Geographical Information Systems in Archaeology", 2<sup>nd</sup> Edition, Cambridge University Press, 2018.

## ONLINE RESOURCES:

- 1 <https://www.alison.com/cyber-security>
- 2 <https://www.ifsacademy.org/advance-networking>
- 3 [https://www.nptel.ac.in/noc22\\_ce26](https://www.nptel.ac.in/noc22_ce26)

## COURSE OUTCOMES:

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

- C01 Explain GIS and cartography.
- C02 Summarize the spatial data and handle spatial and non-spatial database.
- C03 Describe various GIS tools and techniques within spatial analytical framework.
- C04 Analyze GIS outputs in different dimensions.
- C05 Apply spatial data analysis to solve natural, environmental and societal problems and challenges.

## CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C03	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C04	3	3	2	2	-	-	-	1	-	-	-	1	2	2
C05	3	2	1	2	-	-	-	1	-	-	-	1	2	2

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**PROFESSIONAL ELECTIVES  
SEMESTER III, ELECTIVE III**

**P23MCEL15**

**WIRELESS NETWORKING**

**L T P C**

**Prerequisites: Computer Networks**

**3 0 0 3**

**COURSE OBJECTIVES:**

- To understand the concept about Wireless networks, protocol stack and standards
- To learn about evolution of 4G Networks, its architecture and applications.
- To study about fundamentals of 3G Services, its protocols and applications

**UNIT I**

**WIRELESS LAN**

**9**

Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum, IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, WirelessHART- IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX

**UNIT II**

**MOBILE NETWORK LAYER**

**9**

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6- Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: 73 Routing: Destination-Sequenced Distance-Vector (DSDV), Dynamic source routing, IoT: CoAP. TCP enhancements for wireless protocols

**UNIT III**

**3G OVERVIEW**

**9**

Overview of UTM Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, 3GPP Architecture, SMS-GMSC/SMS-IW MSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol, User equipment, CDMA2000 overview- Radio and Network components, Network structure, Radio Network, TDDMA, TD – SCDM

**UNIT IV**

**4G NETWORKS**

**9**

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Cognitive Radio, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.

**UNIT V**

**5G NETWORKS**

**9**

Introduction to 5G, vision and challenges, 5G NR – New Radio – air interface of 5G, radio access, Ultra-Dense Network Architecture and Technologies for 5G- Generalized frequency division multicarrier (GFDM)- Principles, Transceiver Block diagram-MIMO in LTE, Theoretical background, Single user MIMO, Multi-user MIMO, Capacity of massive MIMO: a summary, Basic forms of massive MIMO implementation.

**TEXT BOOKS:**

**TOTAL: 45 PERIODS**

- 1 William Stallings, "Wireless Communications and Networks", 2<sup>nd</sup> Edition, Pearson Education, 2021.

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- 2 Kaveh Pahlavan, Allen H Levesque, "Wireless Information Networks", 4<sup>th</sup> Edition, John Wiley & Sons - IEEE Press, 2019.

#### REFERENCES:

- 1 Thomas L Marzetta, Erik G Larsson, Hong Yang, HienQuoc Ngo, "Fundamentals of Massive MIMO", 1<sup>st</sup> Edition, Cambridge University Press, 2020.
- 2 Saad Z Asif, "5G Mobile Communication, Concepts and Challenges", 1<sup>st</sup> Edition, CRC Press, 2018.
- 3 T S Rappaport, "Wireless Communications: Principles and Practice", 3<sup>rd</sup> Edition, Prentice Hall of India, 2022.

#### ONLINE RESOURCES:

- 1 <https://utsa.pressbooks.pub/networking/chapter/introduction-wireless/>
- 2 <https://www.sciencedirect.com/topics/computer-science/wireless-networking>
- 3 <https://www.shiksha.com/online-courses/articles/wireless-networking/>

#### COURSE OUTCOMES:

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

- C01 Explain the wireless network environment for an application based factors.
- C02 Explain Packet Delivery from source to destination in a mobile network.
- C03 Apply 3G wireless technology and protocol based on the requirement.
- C04 Evaluate various 4G networking technologies and their unique functionalities.
- C05 Analyze latest network Architecture, its principles and evolution.

#### CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C03	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C04	3	3	2	3	-	-	-	1	-	-	-	1	2	2
C05	3	3	2	2	-	-	-	1	-	-	-	1	2	2

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P23MCEL16

## BLOCKCHAIN TECHNOLOGIES

L T P C

Prerequisites: Distributed Systems

3 0 0 3

### COURSE OBJECTIVES:

- To understand the concept of Blockchain technology.
- To explore various aspects of Bitcoin and Cryptocurrency technology.
- To implement the idea about private and public Blockchain

<b>UNIT I</b>	<b>INTRODUCTION OF CRYPTOGRAPHY AND BLOCKCHAIN</b>	<b>9</b>
Introduction to Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions and Blocks, P2P Systems, Keys as Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain.		
<b>UNIT II</b>	<b>BITCOIN AND CRYPTOCURRENCY</b>	<b>9</b>
Introduction to Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double-Spend Problem, Blockchain and Digital Currency, Transactional Blocks, Impact of Blockchain Technology on Cryptocurrency		
<b>UNIT III</b>	<b>INTRODUCTION TO ETHEREUM</b>	<b>9</b>
Introduction to Ethereum, Consensus Mechanisms, Metamask Setup, Ethereum Accounts, Transactions, Receiving Ethers, Smart Contracts.		
<b>UNIT IV</b>	<b>INTRODUCTION TO HYPERLEDGER AND SOLIDITY PROGRAMMING</b>	<b>9</b>
Introduction to Hyperledger, Distributed Ledger Technology & its Challenges, Hyperledger & Distributed Ledger Technology, Hyperledger Fabric, Hyperledger Composer. Solidity - Language of Smart Contracts, Installing Solidity & Ethereum Wallet, Basics of Solidity, Layout of a Solidity Source File & Structure of Smart Contracts, General Value Types.		
<b>UNIT V</b>	<b>BLOCKCHAIN APPLICATIONS</b>	<b>9</b>
Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain, Alt Coins		

**TOTAL: 45 PERIODS**

### TEXT BOOKS:

- 1 Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained", 2<sup>nd</sup> Edition, Packt Publishing, 2018.
- 2 Narayanan, J Bonneau, E Felten, A Miller, S Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction" Princeton University Press, 2017.

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### REFERENCES:

- 1 Antonopoulos, "Mastering Bitcoin", O'Reilly Publishing, 2020.
- 2 Antonopoulos, G Wood, "Mastering Ethereum: Building Smart Contracts and Dapps", O'Reilly Publishing, 2018.
- 3 D Drescher, "Blockchain Basics", Apress, 2017.

### ONLINE RESOURCES:

- 1 <https://www.simplilearn.com/tutorials/blockchain-tutorial/blockchain-technology>
- 2 <https://www.sciencedirect.com/science/article/pii/S266660302100021X>
- 3 <https://www.blockgeeks.com/guides/what-is-blockchain-technology/>

### COURSE OUTCOMES:

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

- C01 Explain the working of Blockchain technology.
- C02 Explain the working of Smart Contracts.
- C03 Analyze the working of Hyperledger.
- C04 Apply the learning of solidity to build de-centralized apps on Ethereum.
- C05 Design applications on Blockchain.

### CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C03	3	3	2	2	-	-	-	1	-	-	-	1	2	2
C04	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C05	3	3	3	3	-	-	-	1	-	-	-	1	2	2

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P23MCEL17

## ORGANIZATIONAL BEHAVIOR

Prerequisites: Human Resource Management

L T P C  
3 0 0 3

### COURSE OBJECTIVES:

- To develop a better conceptualization of organizational life.
- To enable the students to understand the Organizational Behavior.
- To analyse various factors affecting Personality Organizational Change.

### UNIT I

#### ORGANIZATIONAL BEHAVIOR INTRODUCTION

9

Organization Behaviour – Definition – Scope and Application in Management – Contributions of Other Disciplines to OB. Emerging Issues in Organizational Behaviour- Organizational behaviour models

### UNIT II

#### INDIVIDUAL PROCESSES

9

Personality – types – Factors influencing personality- Theories. Emotions - Theories – Emotional Intelligence- Learning – Types of learners – The learning process – Learning theories. 80 Perceptions – Importance – Factors influencing perception- Attitudes – Nature of Attitudes Components of Attitudes Formation of Attitude Benefits of Positive Attitude Functions of Attitudes- Measurement-Motivation – Importance – Types – Theories

### UNIT III

#### LEADERSHIP AND POWER

9

Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power – Power centers – Power and Politics.

### UNIT IV

#### GROUP DYNAMICS

9

Meaning – Types of Groups – Functions of Small Groups – Group Size Status – Managerial Implications – Group Behaviour – Group Norms – Cohesiveness – Group Thinking

### UNIT V

#### ORGANIZATIONAL CHANGE AND DEVELOPMENT

9

Organizational Change: Meaning – Nature of Work Change – Need for Change – Change Process – Types of Change – Factors Influencing Change – Resistance to Change – Overcoming Resistance – Organizational Development: Meaning and Different Types of OD Interventions

**TOTAL: 45 PERIODS**

### TEXT BOOKS:

- 1 K Aswathappa, "Organizational Behavior", 11<sup>th</sup> Edition, Himalaya Publishing House Pvt. Ltd, 2021.
- 2 Stephen P Robbins, "Organizational Behavior", Global Edition, Pearson Education, 2019.

### REFERENCES:

- 1 Fred Luthans, "Organizational Behavior", 13<sup>th</sup> Edition, Tata McGraw Hill, 2017.
- 2 Ivancevich, Konopaske Matteson, "Organizational Behaviour & Management", 7<sup>th</sup> Edition, Tata McGraw Hill, 2019.
- 3 Jason Colquitt, Jeffery LePine, Michael Wesson, "Organizational Behavior: Improving Performance and Commitment in the Workplace", 6<sup>th</sup> Edition, Tata McGraw Hill, 2020.

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**ONLINE RESOURCES:**

- 1 <https://www.apcas.ac.in/download/downloads/0102221541171740>
- 2 <https://www.investopedia.com/terms/o/organizational-behavior>
- 3 <https://www.capterra.com/resources/what-is-organizational-behavior/>

**COURSE OUTCOMES:**

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

- CO1 Describe the human behavior in organization.
- CO2 Explain the framework for managing individual and group performance.
- CO3 Analyze issues and concerns in organizational behavior at the workplace
- CO4 Analyze the effective management of individuals and group behavior
- CO5 Apply concepts of OB to handle problems in the work environment.

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO2	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO3	3	3	2	2	-	-	-	1	-	-	-	1	2	2
CO4	3	3	2	2	-	-	-	1	-	-	-	1	2	2
CO5	3	2	1	2	-	-	-	1	-	-	-	1	2	2

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P23MCEL18

**SERVICE ORIENTED ARCHITECTURE**

L T P C  
3 0 0 3

Prerequisites: Software Engineering

**COURSE OBJECTIVES:**

- To learn XML concepts and exposed to build applications based on XML.
- To gain knowledge about SOAP, HTTP and UDDI to create web services.
- To understand the SOA architecture and principles of Service Oriented Architecture.

**UNIT I**

**XML AND WEB SERVICES**

9

XML structure – Elements – Creating Well-formed XML - Name Spaces – Schema Elements, Types, Attributes – XSL Transformations – Parser – Web Services Overview – Architecture.

**UNIT II**

**WSDL, SOAP and UDDI**

9

WSDL - Overview Of SOAP – HTTP – XML-RPC – SOAP: Protocol – Message Structure – Intermediaries – Actors – Design Patterns And Faults – SOAP With Attachments – UDDI.

**UNIT III**

**SOA BASICS**

9

Roots of SOA – Characteristics of SOA - Comparing SOA to client-server and distributed internet architectures – Anatomy of SOA- How components in an SOA interrelate - Principles of service orientation – Service Layers.

**UNIT IV**

**SOA in J2EE and .NET**

9

SOA platform basics – SOA support in J2EE – Java API for XML-based web services (JAX-WS) - Java architecture for XML binding (JAXB) – Java API for XML Registries (JAXR) - Java API for XML based RPC (JAX-RPC) – JAX-RS SOA support in .NET – ASP.NET web services.

**UNIT V**

**CLOUD COMPUTING**

9

Vision of Cloud computing – Cloud Definition – Characteristics and Benefits – Virtualization – Cloud computing Architecture – Cloud Reference Model, Types of Clouds – Cloud Platforms in Industry

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Thomas Erl, Benjamin Carlyle, Cesare Pautasso, "Service-Oriented Architecture: Concepts, Technology, and Design", 2<sup>nd</sup> Edition, Prentice Hall of India, 2018.
- 2 Eric A Marks, Michael Bell, "Service-Oriented Architecture (SOA): Concepts, Technology, and Design", 3<sup>rd</sup> Edition, John Wiley & Sons, 2018.

**REFERENCES:**

- 1 Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2017.
- 2 Philip A Bernstein, Eric Newcomer, "Principles of Transaction Processing", 2<sup>nd</sup> Edition, Morgan Kaufmann, 2017.
- 3 Philip Wik, Thomas Erl, André Tost, Peter Zimmerer, "Enterprise Service Bus: Theory in Practice", 3<sup>rd</sup> Edition, Packt Publishing, 2018.

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**ONLINE RESOURCES:**

- 1 <https://www.ibm.com/topics/soa>
- 2 <https://www.oracle.com/in/service-oriented-architecture-soa/>
- 3 <https://www.talend.com/resources/service-oriented-architecture/>

**COURSE OUTCOMES:**

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

- C01 Understand the basic structure of XML and to design and store data in XML
- C02 Apply SOAP, HTTP and UDDI services in the web applications.
- C03 Describe SOA architecture and the underlying design principles for the web projects
- C04 Summarize the role of SOA in J2EE and .NET.
- C05 Explain about the cloud computing architecture and the types of clouds

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C03	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C04	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C05	2	2	1	1	-	-	-	1	-	-	-	1	2	2

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P23MCEL19

**HUMAN RESOURCE MANAGEMENT**

L T P C  
3 0 0 3

**Prerequisites: Principles of Management**

**COURSE OBJECTIVES:**

- To understand the importance of human resources and planning process.
- To understand the stages of employee socialization and training needs.
- To know about the purposes of performance management systems and appraisal.

**UNIT I UNDERSTANDING HRM WITH LEGAL & ETHICAL CONTEXT 9**

Introduction- Importance of HRM – functions – Structure of HRM Department-Trends and opportunities – External Influences Affect HRM- HRM in global environment – The Changing World of Technology- HR & Corporate Ethics – Equal Employment Opportunities -Laws Affecting discriminatory practices – Enforcing Equal Opportunity Employment-Discipline & Employee Rights

**UNIT II STAFFING, RECRUITING AND FOUNDATIONS OF SELECTION 9**

Introduction – An Organizational Framework- Job analysis -Methods -Purpose– Recruiting Goals – Recruiting Sources – Recruiting A Global Perspective- Selection Process – Selection from Global Perspective- job offers – Avoiding hiring mistakes - key element for successful predictors

**UNIT III TRAINING AND DEVELOPMENT 9**

Introduction – Socialization Process-Purpose of New employee orientation, Employee training- Employee Development– Organization development Calm Waters Metaphor – White-Water Rapids Metaphor – Evaluating training and Development Effectiveness international training and development issues – Career Development -Value for organization and individual – mentoring and coaching – traditional career stages.

**UNIT IV PERFORMANCE EVALUATION, REWARDS AND BENEFITS 9**

Appraisal process – methods – factors distort appraisal – team appraisal – international appraisal --rewards -Theories of motivation - compensation administration – job evaluation and pay structure – special cases of compensation – executive compensation programs – employee benefits Voluntary Benefits- International Compensation.

**UNIT V SAFE AND HEALTHY WORK ENVIRONMENT 9**

Occupational safety and health act -Contemporary Health and Safety Issues –Employee assistance program – International Safety & Health -labor management - employee unions – labor legislation- Unionizing Employees- Collective Bargaining.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Biswajeet Pattanayak, "Human Resource Management", Prentice Hall of India, 2020.
- 2 Decenzo, Robbins, "Human Resource Management", 16<sup>th</sup> Edition, John Wiley & Sons, 2021.

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## REFERENCES:

- 1 Wayne Cascio, "Managing Human Resource", 12<sup>th</sup> Edition, Tata McGraw Hill, 2021.
- 2 Ivancevich, "Human Resource Management", Tata McGraw Hill, 2017.
- 3 Dessler, "Human Resource Management", 17<sup>th</sup> Edition, Pearson Education, 2022.

## ONLINE RESOURCES:

- 1 <https://www.timechamp.io/blogs/what-is-human-resource-management-hrm/>
- 2 <https://www.whaishumanresource.com/human-resource-management>
- 3 <https://www.servicenow.com/products/hr-service-delivery/what-is-hr-management>

## COURSE OUTCOMES:

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

- CO1 Explain the primary external influences affecting HRM.
- CO2 Apply the components and the goals of staffing, training and development.
- CO3 Analyze the selection procedure in various organizations.
- CO4 Describe the practices used to retain the employees.
- CO5 Analyze the stress and the cause of burn out

## CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	1	-	-	-	1	2	2
CO2	3	2	1	1	-	-	-	1	-	-	-	1	2	2
CO3	3	3	1	2	-	-	-	1	-	-	-	1	2	2
CO4	2	1	1	1	-	-	-	1	-	-	-	1	2	2
CO5	3	3	1	2	-	-	-	1	-	-	-	1	2	2

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**P23MCEL20 SOFTWARE TESTING AND QUALITY ASSURANCE** L T P C  
**Prerequisites: Software Engineering** 3 0 0 3

**COURSE OBJECTIVES:**

- To understand the fundamentals of software testing and its methodologies.
- To familiarize with various quality standards, models and understand their implications for software quality management.
- To learn about metrics and measurement techniques for software quality and testing.

**UNIT I INTRODUCTION 9**

Basic concepts and Preliminaries – Theory of Program Testing– Unit Testing – Control Flow Testing –Data Flow Testing– System Integration Testing

**UNIT II SOFTWARE TESTING METHODOLOGY 9**

Software Test Plan–Components of Plan - Types of Technical Reviews - Static and Dynamic Testing- – Software Testing in Spiral Manner - Information Gathering - Test Planning - Test Coverage - Test Evaluation - Acceptance Test – Summarize Testing Results.

**UNIT III EMERGING SPECIALIZED AREAS IN TESTING 9**

Test Process Assessment – Test Automation Assessment - Test Automation Framework –Agile Testing – Testing Centre of Excellence – Onsite/Offshore Model - Modern Software Testing Tools – Software Testing Trends – Methodology to Develop Software Testing Tools.

**UNIT IV SOFTWARE QUALITY MODELS 9**

Software quality –Verification versus Validation– Components of Quality Assurance – SQA Plan – Quality Standards – CMM – PCMM – CMMI – Malcolm Baldrige National Quality Award.

**UNIT V QUALITY THROUGH CONTINUOUS IMPROVEMENT PROCESS 9**

Role of Statistical Methods in Software Quality – Transforming Requirements into Test Cases – Deming’s Quality Principles – Continuous Improvement through Plan Do Check Act (PDCA)

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 William E Lewis, “Software Testing and Continuous Quality Improvement”, 3<sup>rd</sup> Edition, Auerbach Publications, 2021.
- 2 Kshirasagar Naik, Priyadarshi Tripathy, “Software Testing and Quality Assurance Theory and Practice”, 2<sup>nd</sup> Edition, John Wiley & Sons, 2018.

**REFERENCES:**

- 1 Ron Patton, “Software Testing”, 2<sup>nd</sup> Edition, Pearson Education, 2021.
- 2 Paul C Jorgensen, “Software Testing, A Craftman’s Approach”, 4<sup>th</sup> Edition, CRC Press Taylor & Francis Group, 2018.

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### ONLINE RESOURCES:

- 1 <https://www.coursera.org/courses?query=software%20testing>
- 2 [https://onlinecourses.nptel.ac.in/noc22\\_cs61/preview](https://onlinecourses.nptel.ac.in/noc22_cs61/preview)
- 3 <https://www.classcentral.com/course/youtube-software-testing-47402>

### COURSE OUTCOMES:

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

- C01** Understand the principles, concepts, and importance of testing.
- C02** Analyze various software testing techniques
- C03** Apply various software testing strategies to identify defects and ensure software quality.
- C04** Analyze various quality standards, models, frameworks and their implications for software quality management.
- C05** Understand the importance of quality metrics and measurement in software testing and qu assurance.

### CO-PO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>C01</b>	2	2	1	1	-	-	-	1	-	-	-	-	2	2
<b>C02</b>	3	3	2	2	-	-	-	1	-	-	-	-	2	2
<b>C03</b>	3	2	1	2	-	-	-	1	-	-	-	-	2	2
<b>C04</b>	3	3	2	2	-	-	-	1	-	-	-	-	2	2
<b>C05</b>	2	2	1	1	-	-	-	1	-	-	-	-	2	2

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OPEN ELECTIVES  
SEMESTER III

P23OEMC01

INTELLECTUAL PROPERTY RIGHTS

L T P C

Prerequisites: Business Law

3 0 0 3

COURSE OBJECTIVES:

- To recognize the importance of IP and to educate the pupils on basic concepts of Intellectual Property Rights.
- To make the students to understand the statutory provisions of different forms of IPRs in simple forms.
- To acquire the procedure of obtaining Patents, Copyrights, Trade Marks & Industrial Design

UNIT I

INTRODUCTION

9

Intellectual property rights - Introduction, Basic concepts, Patents, Copyrights, Trademarks, Trade Secrets, Geographic Indicators; Nature of Intellectual Property, Technological Research, Inventions and Innovations, History - the way from WTO to WIPO, TRIPS.

UNIT II

PROCESS

9

New Developments in IPR, Procedure for grant of Patents, TM, GIs, Patenting under Patent Cooperation Treaty, Administration of Patent system in India, Patenting in foreign countries.

UNIT III

STATUTES

9

International Treaties and conventions on IPRs, The TRIPs Agreement, PCT Agreement, The Patent Act of India, Patent Amendment Act (2005), Design Act, Trademark Act, Geographical Indication Act, Bayh-Dole Act and Issues of Academic Entrepreneurship.

UNIT IV

STRATEGIES IN INTELLECTUAL PROPERTY

9

Strategies for investing in R&D, Patent Information and databases, IPR strength in India, Traditional Knowledge, Case studies.

UNIT V

MODELS

9

The technologies Know-how, concept of ownership, Significance of IP in Value Creation, IP Valuation and IP Valuation Models, Application of Real Option Model in Strategic Decision Making, Transfer and Licensing.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 William Patry, "Patry on Copyright", 10<sup>th</sup> Edition, Thomson Reuters, 2019.
- 2 Robert P Merges, Peter S Menell "Intellectual Property in the New Technological Age", 6<sup>th</sup> Edition, Wolters Kluwer, 2020.

REFERENCES:

- 1 G B Reddy, "Intellectual Property Rights and Law", Reprint Edition, Gogia Law Agency, 2020.

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- 2 David Bainbridge, "Intellectual Property", 10<sup>th</sup> Edition, Pearson Education, 2018.
- 3 Cornish, William R. and Llewelyn, David, "Intellectual Property: Patents, Copyrights, Trademarks and Allied Rights", 9<sup>th</sup> Edition, Sweet & Maxwell, 2017.

**ONLINE RESOURCES:**

- 1 <https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf>
- 2 <https://www.facebook.com/krmuniv/videos/fdp-on-meaningful-research-and-ipr/1111028616288503/>
- 3 [https://onlinecourses.nptel.ac.in/noc22\\_hs59/preview](https://onlinecourses.nptel.ac.in/noc22_hs59/preview)

**COURSE OUTCOMES:**

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

- CO1** Explain intellectual property and appreciation of the need to protect it.
- CO2** Summarize about the process of patenting.
- CO3** Analyze the statutes related to IPR.
- CO4** Describe strategies to protect intellectual property.
- CO5** Apply the models for making strategic decisions related to IPR.

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO2	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO3	3	3	2	2	-	-	-	1	-	-	-	1	2	2
CO4	2	2	1	1	-	-	-	1	-	-	-	1	2	2
CO5	3	2	1	2	-	-	-	1	-	-	-	1	2	2

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- 2 Shai Shalev-Shwartz, Shai Ben-David, "Understanding Machine Learning", Cambridge University Press. 2017.
- 3 Ethem Alpaydin, "Machine Learning: The New AI", 3rd Edition, MIT Press, 2020.

### ONLINE RESOURCES:

- 1 <https://www.ibm.com/topics/deep-learning>
- 2 <https://www.coursera.org/articles/ai-vs-deep-learning-vs-machine-learning-beginners-guide>
- 3 [https://onlinecourses.nptel.ac.in/noc23\\_ee87/preview](https://onlinecourses.nptel.ac.in/noc23_ee87/preview)

### COURSE OUTCOMES:

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

- C01 Describe the categorization of machine learning algorithms.
- C02 Describe the types of neural network architectures, activation functions.
- C03 Explain the pattern association using neural networks
- C04 describe various terminologies related with pattern recognition and architectures of convolutional neural networks
- C05 Construct different feature selection and classification techniques and advanced neural network architectures such as RNN, Autoencoders, and GANs.

### CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C03	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C04	2	2	1	2	-	-	-	1	-	-	-	1	2	2
C05	3	3	3	3	-	-	-	1	-	-	-	1	2	2

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P23OEMC02

**MACHINE LEARNING AND DEEP LEARNING**

L T P C

Prerequisites: Probability and Statistics

3 0 0 3

**COURSE OBJECTIVES:**

- To Understand about the learning problem and algorithms
- To Learn about the machine learning fundamentals and pattern recognition
- To apply deep learning algorithms for solving real life problems.

**UNIT I**

**LEARNING PROBLEMS AND ALGORITHMS**

9

Various paradigms of learning problems, Supervised, Semi-supervised and Unsupervised algorithms

**UNIT II**

**NEURAL NETWORKS**

9

Differences between Biological and Artificial Neural Networks - Typical Architecture, Common Activation Functions, Multi-layer neural network, Linear Separability, Hebb Net, Perceptron, Adaline, Standard Back propagation Training Algorithms for Pattern Association - Hebb rule and Delta rule, Hetero associative, Auto associative, Kohonen Self Organising Maps, Examples of Feature Maps, Learning Vector Quantization, Gradient descent, Boltzmann Machine Learning.

**UNIT III**

**MACHINE LEARNING - FUNDAMENTALS & FEATURE SELECTIONS & CLASSIFICATIONS**

9

Classifying Samples: The confusion matrix, Accuracy, Precision, Recall, F1- Score, the curse of dimensionality, training, testing, validation, cross validation, overfitting, under-fitting the data, early stopping, regularization, bias and variance. Feature Selection, normalization, dimensionality reduction, Classifiers: KNN, SVM, Decision trees, Naïve Bayes, Binary classification, multi class classification, clustering.

**UNIT IV**

**DEEP LEARNING: CONVOLUTIONAL NEURAL NETWORKS**

9

Feed forward networks, Activation functions, back propagation in CNN, optimizers, batch normalization, convolution layers, pooling layers, fully connected layers, dropout, Examples of CNNs.

**UNIT V**

**DEEP LEARNING: RNNs, AUTOENCODERS AND GANS**

9

State, Structure of RNN Cell, LSTM and GRU, Time distributed layers, Generating Text, Autoencoders: Convolutional Autoencoders, Denoising autoencoders, Variational autoencoders, GANs: The discriminator, generator, DCGANs

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2<sup>nd</sup> Edition, O'Reilly Media, 2019.
- 2 Andreas C. Müller, Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", 1<sup>st</sup> Edition, O'Reilly Media, 2017.

**REFERENCES:**

- 1 Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning. Trevor Hastie", 2nd Edition. 2017.

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**P230EMC03**

**IOT FOR SMART SYSTEMS**

**Prerequisites: Embedded Systems and Hardware**

**L T P C**  
**3 0 0 3**

**COURSE OBJECTIVES:**

- To study about Internet of Things technologies and its role in real time applications.
- To provide insight about the embedded processor and sensors required for IoT.
- To familiarize the different platforms and Attributes for IoT.

**UNIT I**

**INTRODUCTION TO INTERNET OF THINGS**

**9**

Overview, Hardware and software requirements for IOT, Sensor and actuators, Technology drivers, Business drivers, Typical IoT applications, Trends and implications.

**UNIT II**

**IOT ARCHITECTURE**

**9**

IoT reference model and architecture -Node Structure - Sensing, Processing, Communication, Powering, Networking - Topologies, Layer/Stack architecture, IoT standards, Cloud computing for IoT, Bluetooth, Bluetooth Low Energy beacons.

**UNIT III**

**PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT**

**9**

**PROTOCOLS:** NFC, SCADA and RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe GSM, CDMA, LTE, GPRS, small cell.

**Wireless technologies for IoT:** WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary systems-Recent trends.

**UNIT IV**

**IOT PROCESSORS**

**9**

**Services/Attributes:** Big-Data Analytics for IOT, Dependability, Interoperability, Security, Maintainability.

**Embedded processors for IOT:** Introduction to Python programming -Building IOT with RASPERRY PI and Arduino.

**UNIT V**

**CASE STUDIES**

**9**

Industrial IoT, Home Automation, smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IOT Defense

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Mahmood Hussain Shah, Anand Nayyar, Naveen Chilamkurti, "Internet of Things for Smart Systems: Technologies, Protocols, and Applications", 1<sup>st</sup> Edition, CRC Press, 2018.
- 2 Liming Chen, Samarjit Chakraborty, Rajkumar Buyya, "Internet of Things: Principles and Paradigms", 2<sup>nd</sup> Edition, Morgan Kaufmann of Elsevier, 2020.

**REFERENCES:**

- 1 Adrian McEwen, Hakim Cassimally "Designing the Internet of Things", John Wiley & Sons, 2019.
- 2 Anupam Joshi, Rajendra Kumar, Balamurugan S, T B Isha, "Internet of Things: A Complete Guide", 1<sup>st</sup> Edition, CRC Press Taylor and Francis Group.

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- 3 Mohamed A El-Sharkawi, "Internet of Things: A Hands-On Approach", 1<sup>st</sup> Edition, Chapman and Hall/CRC Press, 2018.

**ONLINE RESOURCES:**

- 1 <https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/>
- 2 [https://onlinecourses.nptel.ac.in/noc21\\_cs17/preview](https://onlinecourses.nptel.ac.in/noc21_cs17/preview)
- 3 <https://www.techtarget.com/whatis/feature/IoT-basics-A-guide-for-beginners>

**COURSE OUTCOMES:**

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

- C01** Analyze the concepts of IoT and its present developments
- C02** Summarize and contrast different platforms and infrastructures available for IoT
- C03** Describe Explain different protocols and communication technologies used in IoT.
- C04** Analyze Describe the big data analytic and programming of IoT
- C05** Evaluate Implement IoT solutions for smart applications

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>C01</b>	3	3	2	2	-	-	-	1	-	-	-	1	2	2
<b>C02</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2
<b>C03</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2
<b>C04</b>	3	3	2	2	-	-	-	1	-	-	-	1	2	2
<b>C05</b>	3	3	2	3	-	-	-	1	-	-	-	1	2	2

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**P23OEMC04**

**HEALTH CARE MANAGEMENT**

**L T P C**  
**3 0 0 3**

**Prerequisites: Business Fundamentals**

**COURSE OBJECTIVES:**

- To understand the basic concepts of health care system.
- To know about creating, accessing and maintaining health care information systems
- To know social media analytics, temporal data mining and visual data analytics for health care data.

**UNIT I**

**INTRODUCTION**

**9**

Introduction to health care information – Health care data quality – Health care information regulations, laws and standards

**UNIT II**

**HEALTH CARE INFORMATION SYSTEMS**

**9**

History and evolution of health care information systems – Current and emerging use of clinical information systems – system acquisition – System implementation and support

**UNIT III**

**INFORMATION TECHNOLOGY**

**9**

Information architecture and technologies that support health care information systems – Health care information system standards – Security of health care information systems.

**UNIT IV**

**MINING AND SOCIAL MEDIA ANALYTICS FOR HEALTH CARE DATA**

**9**

Resources – Terminology Acquisition and Management – Information Extraction – Text Mining Environments – Applications – Social Media Analysis for Public Health Research – Analysis of Social Media use in Healthcare

**UNIT V**

**TEMPORAL DATA MINING AND VISUAL ANALYTICS FOR HEALTH CARE**

**9**

Association Analysis – Temporal Pattern Mining – Sensor Data Analysis – Introduction to Visual Analysis and Medical Data Visualization – Visual Analytics in Health care – Visual Analytics for Clinicians.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Peter C Olden, Pauline E Jensen, Herbert E. Braverman, "Health Care Management: Organization Design and Behavior", 7<sup>th</sup> Edition, Delmar Cengage Learning, 2018.
- 2 Sharon B Buchbinder, Nancy H. Shanks, "Introduction to Health Care Management", 4<sup>th</sup> Edition, Jones & Bartlett Learning, 2018.

**REFERENCES:**

- 1 Karen A Wager, Frances Wickham Lee, John P Glaser, "Managing Health Care Information Systems: A Practical Approach for Health Care Executives", 2<sup>nd</sup> Edition, John Wiley & Sons, 2017.
- 2 Leonard H Friedman, Anthony R Kovner, "Management in Health Care Organizations: Theory and Practice", 4<sup>th</sup> Edition, Jossey-Bass, 2018.
- 3 Beaufort B Longest Jr, "Health Policy making", 7<sup>th</sup> Edition, Health Administration Press, 2018.

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## ONLINE RESOURCES:

- 1 <https://www.geeksforgeeks.org/hospital-management-system-project-in-software-development/>
- 2 [https://www.academia.edu/30270016/Introduction\\_to\\_Health\\_Care\\_Management](https://www.academia.edu/30270016/Introduction_to_Health_Care_Management)
- 3 <https://www.techtarget.com/searchhealthit/resources/Health-IT-infrastructure>

## COURSE OUTCOMES:

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

- C01 Design a basic research skills applicable to the design, evaluation and implementation of appropriate Healthcare Information Systems (HIS).
- C02 Explain the impact, strengths and weaknesses of various HIS in any healthcare settings.
- C03 Describe health care data in temporal data mining.
- C04 Apply sensor data and visual data analytics in health care applications.
- C05 Analyze how to apply state and federal healthcare policies.

## CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	3	3	-	-	-	1	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C03	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C04	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C05	3	3	2	2	-	-	-	1	-	-	-	1	2	2

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**P230EMC05 ENVIRONMENTAL SUSTAINABILITY** **L T P C**  
**Prerequisites: Resource Management** **3 0 0 3**

**COURSE OBJECTIVES:**

- To define and apply sustainability principles within their academic programs
- To explain how natural, economic, and social systems interact to foster or prevent sustainability
- To Analyze and explain local, national, and global sustainability using a multidisciplinary approach

**UNIT I INTRODUCTION 9**

Valuing the Environment: Concepts, Valuing the Environment: Methods, Property Rights, Externalities, and Environmental Problems

**UNIT II CONCEPT OF SUSTAINABILITY 9**

Sustainable Development: Defining the Concept, the Population Problem, Natural Resource Economics: An Overview, Energy, Water, Agriculture

**UNIT III SIGNIFICANCE OF BIODIVERSITY 9**

Biodiversity, Forest Habitat, Commercially Valuable Species, Stationary - Source Local Air Pollution, Acid Rain and Atmospheric Modification, Transportation

**UNIT IV POLLUTION IMPACTS 9**

Water Pollution, Solid Waste and Recycling, Toxic Substances and Hazardous Wastes, Global Warming.

**UNIT V ENVIRONMENTAL ECONOMICS 9**

Development, Poverty, and the Environment, Visions of the Future, Environmental economics and policy by Tom Tietenberg, Environmental Economics

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Stephen Morse, Yosef Jabareen, "Sustainability and the Built Environment", 1<sup>st</sup> Edition, Routledge, 2018.
- 2 John A Dernbach, "Environmental Law, Policy, and Economics: Reclaiming the Environmental Agenda", 2<sup>nd</sup> Edition, Carolina Academic Press, 2018.

**REFERENCES:**

- 1 Niko Roorda, Fundamentals of Sustainable Development, 3<sup>rd</sup> Edition, Routledge, 2020.
- 2 Bhavik R Bakshi., Sustainable Engineering: Principles and Practice, Cambridge University Press. 2019.

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- 3 John H Cushman, "Environmental Sustainability: Practical Global Applications", 1<sup>st</sup> Edition, CRC Press, 2017.

#### ONLINE RESOURCES:

- 1 <https://ncert.nic.in/textbook/pdf/keec109.pdf>
- 2 <https://www.slideshare.net/slideshow/environmental-sustainability-ppt/250073328>
- 3 [https://onlinecourses.swayam2.ac.in/nou20\\_ag12/preview](https://onlinecourses.swayam2.ac.in/nou20_ag12/preview)

#### COURSE OUTCOMES:

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

- C01** Explain the ways that sustainability topics are approached by a diversity of academic disciplines.
- C02** Summarize concepts of interdependence and dynamic interrelationships within and between social and ecological systems.
- C03** Describe how systemic limits and globalized processes impact socio ecological systems and impose social differences. .
- C04** Analyze human and ecological health and social equity in problem solving strategies.
- C05** Apply creative responses that inform sustainable approaches to promote resilient communities.

#### CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>C01</b>	2	2	1	1	-	-	2	2	-	-	-	1	2	2
<b>C02</b>	2	2	1	1	-	-	2	2	-	-	-	1	2	2
<b>C03</b>	2	2	1	1	-	-	2	2	-	-	-	1	2	2
<b>C04</b>	3	3	2	2	-	-	3	3	-	-	-	1	2	2
<b>C05</b>	3	2	1	2	-	-	3	3	-	-	-	1	2	2

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## VALUE ADDED COURSES (VAC)

<b>P23VA01</b>	<b>DISASTER MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Prerequisites: Nil</b>		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

### COURSE OBJECTIVES:

- To reduce the damage, death, sufferings and destruction of any natural and human induced disaster.
- To identifying the hazard and its cause.
- To increasing the strength among people to survive against disasters.

### UNIT I INTRODUCTION 6

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

### UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS 6

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

### UNIT III DISASTER PRONE AREAS IN INDIA 6

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

### UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT 6

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

### UNIT V RISK ASSESSMENTS 6

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

**TOTAL : 30 PERIODS**

### TEXT BOOKS:

- 1 Michael K. Lindell, Carla Prater, Ronald W. Perry, "Emergency Management: Concepts and Strategies for Effective Programs", 2<sup>nd</sup> Edition, John Wiley & Sons, 2019.
- 2 George Haddow, Jane Bullock, Damon P. Coppola "Introduction to Emergency Management", 6<sup>th</sup> Edition, Butterworth-Heinemann, 2018.

### REFERENCES:

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- 1 Goel S L, "Disaster Administration and Management Text and Case Studies", Deep & Deep Publication Pvt. Ltd., 2020.
- 2 Nishitha Rai, Singh A K, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company, 2021.
- 3 Brenda D. Phillips, David M. Neal, Gary Webb," Introduction to Emergency Management", 6<sup>th</sup> Edition, Butterworth-Heinemann, 2018.

**ONLINE RESOURCES:**

- 1 [https:// nidm.gov.in/online.asp/](https://nidm.gov.in/online.asp/)
- 2 [https:// elearning.nidm.gov.in/](https://elearning.nidm.gov.in/)
- 3 [https:// get.disasterready.org /](https://get.disasterready.org/)

**COURSE OUTCOMES:**

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

- CO1** Summarize basics of disaster.
- CO2** Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- CO3** Explain disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- CO4** Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- CO5** Evaluate the strengths and weaknesses of disaster management approaches.

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2
<b>CO2</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2
<b>CO3</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2
<b>CO4</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2
<b>CO5</b>	3	3	2	3	-	-	-	1	-	-	-	1	2	2

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<b>P23VA02</b>	<b>ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Prerequisites: Nil</b>		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

**COURSE OBJECTIVES:**

- To understand the traditional knowledge and its characteristics
- To know the need of protecting traditional knowledge.
- To understand the legal framework of TK and IPR.

**UNIT I INTRODUCTION TO TRADITIONAL KNOWLEDGE 6**

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge vs western knowledge traditional knowledge vis-à-vis formal knowledge.

**UNIT II PROTECTION OF TRADITIONAL KNOWLEDGE 6**

The need for protecting traditional knowledge Significance of TK Protection, the value of TK in the global economy, Role of Government to harness TK.

**UNIT III LEGAL FRAMEWORK AND TRADITIONAL KNOWLEDGE 6**

A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act); B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003.

**UNIT IV TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY 6**

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

**UNIT V TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS 6**

Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

**TOTAL : 30 PERIODS**

**TEXT BOOKS:**

- 1 Amartya Sen, "The Argumentative Indian: Writings on Indian History, Culture and Identity", Penguin Books.
- 2 David Frawley (Vamadeva Shastri), "Wisdom of the Ancient Seers: Mantras of the Rig Veda", Revised Edition, Motilal Banarsidass, 2017.

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## REFERENCES:

- 1 Amit Jha, "Traditional Knowledge System in India", Atlantic publishers, 2024.
- 2 Kapil Kapoor, "Knowledge Traditions and Practices of India", Michel Danino, 2024.
- 3 A P J Abdul Kalam, Srijan Pal Singh, "Advantage India: From Challenge to Opportunity", HarperCollins.

## ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/101104065/>
- 2 <https://www.goseeko.com/universities/>
- 3 <https://iksindia.org/>

## Course outcomes:

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

- C01 Describe the concept of Traditional knowledge and its importance.
- C02 Explain the need and importance of protecting traditional knowledge
- C03 Describe the various enactments related to the protection of traditional knowledge
- C04 Explain the concepts of Intellectual property to protect the traditional knowledge.
- C05 Summarize the traditional knowledge in different sectors.

## CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C03	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C04	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C05	2	2	1	1	-	-	-	1	-	-	-	1	2	2

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P23VA03

CONSTITUTION OF INDIA

L T P C

Prerequisites: Nil

2 0 0 0

**COURSE OBJECTIVES:**

- To understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
- Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.

**UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION 6**

History, Drafting Committee, (Composition & Working)

**UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION 6**

Preamble, Salient Features

**UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES 6**

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

**UNIT IV : ORGANS OF GOVERNANCE 6**

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

**UNIT V LOCAL ADMINISTRATION 6**

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

**TEXT BOOKS:**

**TOTAL : 30 PERIODS**

- 1 "The Constitution of India, 1950 (Bare Act)", Government Publication, 2020.
- 2 M P Jain, "Indian Constitution Law", 8<sup>th</sup> Edition. Lexis Nexis, 2018.
- 3 D D Basu, "Introduction to the Constitution of India", 26<sup>th</sup> Edition Lexis Nexis, 2022

**REFERENCES:**

- 1 "Constitution of India "LexisNexis, Eastern Book Company, and Universal Law Publishing Co.
- 2 Dr.S.N.Busi, Dr.B. R. Ambedkar "Framing of Indian Constitution, 1<sup>st</sup> Edition, 2016.
- 3 P M Baksh, "Constitution of India", LexisNexis, 2023.

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### ONLINE RESOURCES:

- 1 [https:// ruralindiaonline.org /](https://ruralindiaonline.org/)
- 2 <https:// www.constitutionofindia.net />
- 3 <https:// www.mercatus.org />

### Course outcomes:

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

- C01 Describe the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- C02 Summarize the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- C03 Explain the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- C04 Explain the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- C05 Explain the passage of the Hindu Code Bill of 1956.

### CO - PO - PSO MAPPING:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C03	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C04	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C05	2	2	1	1	-	-	-	1	-	-	-	1	2	2

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## UNIT I

## சங்க இலக்கியம்

6

- 1 தமிழின் துவக்க நூல் தொல்காப்பியம் - எழுத்து, சொல், பொருள்
- 2 அகநானூறு (82) - இயற்கை இன்னிசை அரங்கம்
- 3 குறிஞ்சிப் பாட்டின் மலர்க்காட்சி - புறநானூறு (95 195)
- 4 போரை நிருத்திய அவ்வையார்

## UNIT II

## அறநெறித்தமிழ்

6

- 1 அறநெறி வகுத்த திருவள்ளுவர் - அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புரவறிதல், ஈகை, புகழ்
- 2 பிற அறநூல்கள் - இலக்கிய மருந்து - ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆச்சாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)

## UNIT III

## இரட்டைக்காப்பியங்கள்

6

- 1 கண்ணகியின் புரட்சி - சிலப்பதிகார வழக்குரை காதை
- 2 சமுகசேவை இலக்கியம் மணிமேகலை - சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை

## UNIT IV

## அருள்நெறித்தமிழ்

6

- 1 சிறுபாணாற்றுப்படை - பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் அவ்வைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள்
- 2 நற்றிணை - அன்னைக்குரிய புன்னை சிறப்பு
- 3 திருமந்திரம் (617, 618) - இயமம் நியமம் விதிகள்
- 4 தர்மசாலையை நிறுவிய வள்ளலார்
- 5 புறநானூறு - சிறுவனே வள்ளலானான்
- 6 அகநானூறு (4) - வண்டு
- 7 நற்றிணை (11) - நண்டு
- 8 கலித்தொகை (11) - யானை, புறா
- 9 ஐந்திணை 50 (27) - மான் ஆகியவை பற்றிய செய்திகள்

## UNIT V

## நவீன தமிழ் இலக்கியம்

6

- 1 உரைநடைத்தமிழ்
  - தமிழின் முதல் புதினம்,
  - தமிழின் முதல் சிநுறுககதை,
  - கட்டுரை இலக்கியம்,
  - பயண இலக்கியம்,
  - நாடகம்.
- 2 நாட்டு விடுதலைப் போராட்டமும் தமிழ் இலக்கியமும்,
- 3 சமுதாய விடுதலையும் தமிழ் இலக்கியமும்,
- 4 பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,

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- 5 அறிவியல் தமிழ்,
- 6 இணையத்தில் தமிழ்,
- 7 சுற்று சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்

**TOTAL : 30 PERIODS**

தமிழ் இலக்கிய வெளியீடுகள் / புத்தகங்கள்:

- 1 தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University) - [www.tamilvu.org](http://www.tamilvu.org)
- 2 தமிழ் விக்கிப்பீடியா (Tamil Wikipedia) - <https://ta.wikipedia.org>
- 3 தர்மபுர ஆதீன வெளியீடு
- 4 வாழ்வியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்
- 5 தமிழ்கலைக் களஞ்சியம் - தமிழ் வளர்ச்சித்துறை ([thamilvalarchithurai.com](http://thamilvalarchithurai.com))
- 6 அறிவியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்

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## BRIDGE COURSE

P23BC01

### DATA STRUCTURES AND ALGORITHMS

Prerequisites: Programming Fundamentals

L T P C  
3 0 2 4

#### COURSE OBJECTIVES:

- To understand the basic techniques of ADT and algorithm analysis.
- To learn linear data structures and nonlinear data structures.
- To Develop problem-solving skills through the application of data structures and algorithms to real-world problems

#### UNIT I

##### INTRODUCTION

Introduction - Abstract Data Types (ADT) - Arrays and its representation - Structures - Fundamentals of algorithmic problem solving - Important problem types - Fundamentals of the analysis of algorithm - analysis framework - Asymptotic notations, Properties, Recurrence Relation. 9

#### UNIT II

##### LINEAR DATA STRUCTURES - LIST

List ADT - Array-based Implementation - Linked list implementation - Singly Linked Lists - Circularly linked lists - Doubly Linked Lists - Applications of linked list - Polynomial Addition. 9

#### UNIT III

##### LINEAR DATA STRUCTURES - STACK, QUEUE

Stack ADT - Operations on Stack - Applications of stack - Infix to postfix conversion - evaluation of expression - Queue ADT - Operations on Queue - Circular Queue - Applications of Queue. 9

#### UNIT IV

##### NON LINEAR DATA STRUCTURES - TREES AND GRAPHS

Trees and its representation - left child right sibling data structures for general trees- Binary Tree - Binary tree traversals -- Binary Search Tree -Graphs and its representation - Graph Traversals - Depth-first traversal - breadth-first traversal-Application of graphs. 9

#### UNIT V

##### SEARCHING, SORTING AND HASH TECHNIQUES

Searching: Linear search - Binary Search- comparison of linear search and binary search, Sorting algorithms: Insertion sort - Bubblesort - selection sort - Hashing: Hash Functions - Separate Chaining Open Addressing - Rehashing. 9

**TOTAL : 45 PERIODS**

#### PRACTICAL EXERCISES:

- 1 Develop a program to perform various array operations.
- 2 Perform Polynomial Manipulation using Single Linked List and various operations in double linked list.
- 3 Write a program to convert infix to postfix using stack datastructure
- 4 Develop a program to perform circular queue operations
- 5 Write a program to delete a node from a given Binary search tree
- 6 Write a program to perform Graph Traversals.
- 7 Write a program to sort a given set of numbers and compare among Bubble Sort, Selection Sort and Insertion Sort with respect to computational complexity

**30 PERIODS**

**TOTAL: 75 PERIODS**

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### TEXT BOOKS:

- 1 A K Sharma, "Data Structures using C", 2<sup>nd</sup> Edition, Pearson Education, 2020.
- 2 Michael T Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", 2<sup>nd</sup> Edition, John Wiley & Sons, 2018.

### REFERENCES:

- 1 Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2<sup>nd</sup> Edition, Pearson Education, 2017.
- 2 Jean Paul Tremblay, Paul G Sorensen, "An Introduction to Data Structures with Applications", 2<sup>nd</sup> Edition, Tata McGraw Hill, 2017.
- 3 Robert Lafore, "Data Structures and Algorithms in Java", 2<sup>nd</sup> Edition, Sams Publishing, 2017.

### ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/106/102/106102064/>
- 2 <https://unacademy.com/goal/nta-ugc-net-set-exams/TEWDQ/topic/RVXW/MILTW>
- 3 <https://www.tableau.com/learn/articles/books-about-data-structures-algorithms>

### COURSE OUTCOMES:

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

- C01 Explain the basics of data structures and their implementations.
- C02 Explain the basic data structures such as arrays, strings, and linked lists.
- C03 Explain the linear data structures such as stacks and queues.
- C04 Implement the tree, heap and graphs along with their basic operations.
- C05 analyze the different techniques for solving problems like sorting and searching

### CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	1	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	1	-	1	2	2
C03	2	2	1	1	-	-	-	1	-	1	-	1	2	2
C04	3	3	3	3	-	-	-	1	-	1	-	1	2	2
C05	3	3	2	2	-	-	-	1	-	1	-	1	2	2

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P23BC02

**PROGRAMMING IN C**

L T P C  
3 0 2 4

**Prerequisites: Basic Programming Concepts**

**COURSE OBJECTIVES:**

- To understand the basic concepts of problem solving approaches and to develop the algorithms.
- To apply the techniques of structured (functional) decomposition to break a program into smaller pieces and describe the mechanics of parameter passing.
- To design, implements, test, and apply the basic C programming concepts.

**UNIT I**

**INTRODUCTION TO COMPUTER PROBLEM SOLVING**

9

Introduction - The Problem Solving aspect - Top down design - Implementation of algorithm - Program Verification - The efficiency of algorithms - The analysis of algorithms - Fundamental Algorithms

**UNIT II**

**PROGRAMMING AND ALGORITHMS**

9

Programs and Programming - building blocks for simple programs -pseudo code representation - flow charts - Programming Languages - compiler - Interpreter, Loader and Linker - Program execution - Classification of Programming Language - Structured Programming Concept - Illustrated Problems: Algorithm to check whether a given number is Armstrong number or not- Find factorial of a number

**UNIT III**

**BASICS OF 'C', INPUT / OUTPUT & CONTROL STATEMENTS**

9

Introduction- Identifier - Keywords - Variables - Constants - I/O Statements Operators - Initialization - Expressions - Expression Evaluation - L values and R values - Type Conversion in C -Formatted input and output functions Specifying Test Condition for Selection and Iteration- Conditional Execution - and Selection - Iteration and Repetitive Execution- go to Statement - Nested Loops- Continue and break statements.

**UNIT IV**

**ARRAYS, STRINGS, FUNCTIONS AND POINTERS**

9

Array - One dimensional Character Arrays- Multidimensional Arrays- Arraysof Strings - Two dimensional character array - functions - parameter passing mechanism scope - storage classes - recursion - comparing iteration and recursion- pointers - pointer operators - uses of pointers- arrays and pointers - pointers and strings - pointer indirection pointers to functions - Dynamic memory allocation.

**UNIT V**

**USER-DEFINED DATATYPES & FILES**

9

Structures - initialization - nested structures - structures and arrays - structures and pointers - union- type def and enumeration types - bit fields -File Management in C - Files and Streams - File handling functions - Sequential access file- Random access file - Command line arguments.

**45 PERIODS**

**PRACTICAL EXERCISES:**

- 1 Write programs to get some input, perform some operation and display the output using I/O statements
- 2 Write programs to implement nested loop.
- 3 Write a program in C to get the largest element of an array using the function.

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- 4 Display all prime numbers between two intervals using functions.
- 5 Reverse a sentence using recursion.
- 6 Write a C program to Store Student Information in Structure and Display it.  
The annual examination is conducted for 10 students for five subjects. Write a program to read the data from a file and determine the following: Total marks obtained by each student; Topper of the class

**30 PERIODS**

**TOTAL : 75 PERIODS**

**TEXT BOOKS:**

- 1 Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming, 1<sup>st</sup> Edition, BCS Learning and Development Ltd., 2020.
- 2 Reema Thareja, "Programming in C", Revised Edition, Pearson Education, 2021.

**REFERENCES:**

- 1 Deitel, "C How to Program", 7<sup>th</sup> Edition, Pearson Education. 2020.
- 2 Byron S Gottfried, "Programming with C, Schaums Outlines, 3<sup>rd</sup> Edition, Tata McGraw Hill, 2018.

**ONLINE RESOURCES:**

- 1 [https://onlinecourses.nptel.ac.in/noc23\\_cs02/preview](https://onlinecourses.nptel.ac.in/noc23_cs02/preview)
- 2 <https://www.javatpoint.com/c-programming-language-tutorial>
- 3 <https://www.digimat.in/nptel/courses/video/106104128/L01.html>

**COURSE OUTCOMES:**

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

- CO1** Explain the basic Problem solving methods.
- CO2** Describe basic Programming and algorithms
- CO3** Comprehend basic input/output control statements in C programming.
- CO4** Describe the Arrays, Strings, Functions and Pointers
- CO5** Explain the user defined data types and Files.

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	2	1	1	1	-	-	-	1	-	-	-	1	2	2
<b>CO2</b>	2	1	1	1	-	-	-	1	-	-	-	1	2	2
<b>CO3</b>	2	1	1	1	-	-	-	1	-	-	-	1	2	2
<b>CO4</b>	2	1	1	1	-	-	-	1	-	-	-	1	2	2
<b>CO5</b>	2	1	1	1	-	-	-	1	-	-	-	1	2	2

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*(Signature)*

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**P23BC03**

**OBJECT ORIENTED PROGRAMMING**

**L T P C**  
**3 0 2 4**

**Prerequisites: Basic Programming Skills**

**COURSE OBJECTIVES:**

- To understand and apply the Object Oriented principles in software development.
- Use the generic programming features of C++ including the STL.
- Design and implement reliable and maintainable object-oriented applications of moderate.

**UNIT I FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING 9**

Object-Oriented Programming concepts – Encapsulation – Programming Elements – Program Structure – Enumeration Types – Functions and Pointers – Function Invocation – Overloading Functions – Scope and Storage Class – Pointer Types – Arrays and Pointers – Call-by-Reference – Assertions.

**UNIT II IMPLEMENTING ADTS AND ENCAPSULATION 9**

Aggregate Type struct – Structure Pointer Operators – Unions – Bit Fields – Data Handling and Member Functions – Classes – Constructors and Destructors – Static Member – this Pointer – reference semantics – implementation of simple ADTs.

**UNIT III POLYMORPHISM 9**

ADT Conversions – Overloading – Overloading Operators – Unary Operator Overloading – Binary Operator Overloading – Function Selection – Pointer Operators – Visitation – Iterators – containers – Sequence Containers - List – List Iterators – Associative Containers.

**UNIT IV TEMPLATES AND FILE HANDLING 9**

Template Class – Function Templates – RTTI Templates - Class Templates – Parameterizing – STL- Algorithms – Function Adaptors – Streams and Formatted I/O – I/O Manipulations -File handling – Random Access.

**UNIT V INHERITANCE 9**

Derived Class – Typing Conversions and Visibility – Code Reuse – Virtual Functions – Templates and Inheritance – Run-Time Type Identifications – Exceptions – Handlers – Standard Exceptions.

**45 PERIODS**

**PRACTICAL EXERCISES:**

- 1 Write a C++ Program to illustrate Enumeration and Function Overloading.
- 2 Write a C++ Program to illustrate the use of Constructors and Destructors and Constructor Overloading.
- 3 Write a Program to overload as binary operator, friend and member function.
- 4 Write a Program to illustrate Iterators and Containers.
- 5 Write a C++ Program to illustrate function and class templates
- 6 Exception Handling
- 7 File Handling – Read, Write, Update

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**30 PERIODS**  
**TOTAL: 75 PERIODS**

*Approved*  




### TEXT BOOKS:

- 1 Bhushan Trivedi, "Programming with ANSI C++", 2<sup>nd</sup> Edition, Oxford Press, 2021.
- 2 E Balagurusamy, "Object oriented Programming with C++", 5<sup>th</sup> Edition, Tata McGraw Hill, 2018.

### REFERENCES:

- 1 H M Deitel, P J Deitel "C++ How to Program", Seventh Edition, Prentice Hall of India, 2020.
- 2 Ira Pohl, "Object-Oriented Programming Using C++", Pearson Education, 2<sup>nd</sup> Edition, 2021.
- 3 Cay S Horstmann, "Big Java: Early Objects", 7<sup>th</sup> Edition, John Wiley & Sons, 2020.

### ONLINE RESOURCES:

- 1 <https://www.javatpoint.com/cpp-oops-concepts>
- 2 <https://www.geeksforgeeks.org/object-oriented-programming-in-cpp/>
- 3 [https://www.w3schools.com/cpp/cpp\\_oop.asp](https://www.w3schools.com/cpp/cpp_oop.asp)

### COURSE OUTCOMES:

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

- C01 Explain object-oriented programming concepts.
- C02 Apply proper class protection mechanism to provide security.
- C03 Apply the concept of virtual functions to implement polymorphism.
- C04 Write a program using C++ features like templates, exceptions and file handling.
- C05 Design code with extensible Class types, User-defined operators and function Overloading.

### CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	1	1	1	-	-	-	1	-	-	-	1	2	2
C02	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C03	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C04	2	1	1	1	-	-	-	1	-	-	-	1	2	2
C05	3	3	3	3	-	-	-	1	-	-	-	1	2	2

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**P23BC04**

**DATABASE MANAGEMENT SYSTEM**

**L T P C**

**Prerequisites: Relational Database Concepts**

**3 0 0 3**

**COURSE OBJECTIVES:**

- To understand the fundamentals of data models and conceptualize and depict a database system using ER diagram.
- To know about data storage techniques, SQL and relational database design.
- To impart knowledge in transaction processing, concurrency control techniques and recovery procedures.

**UNIT I**

**INTRODUCTION**

**9**

File systems versus Database systems - Data Models - DBMS Architecture - Data Independence - Data Modeling using Entity - Relationship Model -E-R Modeling.

**UNIT II**

**RELATIONAL MODEL AND QUERY EVALUATION**

**9**

Relational Model Concepts - Relational Algebra - SQL - Basic Queries - Complex SQL Queries - Views - Constraints.

**UNIT III**

**DATABASE DESIGN & APPLICATION DEVELOPMENT**

**9**

Functional Dependencies - Non-loss Decomposition - First, Second, Third Normal Forms, Dependency Preservation - Boyce/Codd Normal Form - Multi-valued Dependencies and Fourth Normal Form - Join Dependencies and Fifth Normal Form.

**UNIT IV**

**TRANSACTION PROCESSING**

**9**

Query Processing-Transaction Processing - Properties of Transactions - Serializability - Transaction support in SQL - Locking Techniques -Validation Techniques -- Recovery concepts - Shadow paging - Log Based Recovery.

**UNIT V**

**FILES AND INDEXING**

**9**

File operations - Hashing Techniques - Indexing - Single level and Multi-level Indexes - B+ tree - Static Hashing.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Abraham Silberschatz, Henry F Korth, S Sundarshan "Database System Concepts", 7<sup>th</sup> Edition, Tata McGraw Hill, 2019.
- 2 Ramez Elmasri, Shamkant Navathe, "Fundamentals of Database Systems", 7<sup>th</sup> Edition, Pearson Education, 2022.

**REFERENCES:**

- 1 C J Date, "An Introduction to Database Systems", 8<sup>th</sup> Edition, Pearson Education, 2021.
- 2 Raghu Ramakrishnan, "Database Management Systems", 4<sup>th</sup> Edition, Tata McGrawHill, 2021.
- 3 Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", 3<sup>rd</sup> Edition, Tata McGraw Hill, 2020.

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**(AN AUTONOMOUS INSTITUTION)**  
**GOWRIVAKKAM, CHENNAI - 600 073.**



## ONLINE RESOURCES:

- 1 <https://www.techtarget.com/searchdatamanagement/definition/database-management-system>
- 2 <https://www.ibm.com/docs/en/zos-basic-skills?topic=zos-what-is-database-management-system>
- 3 <https://www.appdynamics.com/topics/database-management-systems>

## COURSE OUTCOMES

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

- C01** Explain the basic concepts and the applications of database systems.
- C02** Explain the basics of SQL and construct queries using SQL.
- C03** Apply normalization for the development of software applications.
- C04** Explain the basics of transaction processing and concurrency control.
- C05** Explain the file and page organizations, indexing methods including B tree and hashing.

## CO-PO-PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>C01</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2
<b>C02</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2
<b>C03</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2
<b>C04</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2
<b>C05</b>	2	2	1	1	-	-	-	1	-	-	-	1	2	2

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**P23BC05 INTRODUCTION TO COMPUTER ORGANIZATION AND OPERATING SYSTEMS** L T P C  
**Prerequisites: Computer Architecture** 3 0 0 3

**COURSE OBJECTIVES:**

- To learn the basic structure and operations of a computer.
- To learn the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit.
- To understand the memory hierarchies, cache memories and virtual memories and to learn the different ways of communication with I/O devices.

**UNIT I FUNDAMENTAL STRUCTURE AND ARITHMETIC OPERATIONS 9**

Functional Units – Basic Operational Concepts – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – Decision Making – MIPS Addressing Arithmetic for Computers.

**UNIT II PROCESSOR AND CONTROL UNIT 9**

A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining – Pipelined datapath and control – Handling Data Hazards & Control Hazards – Exceptions.

**UNIT III MEMORY & I/O SYSTEMS 9**

Memory Hierarchy - Memory technologies – cache memory – measuring and improving cache performance – virtual memory --Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure –Interface circuits – USB

**UNIT IV OPERATING SYSTEMS OVERVIEW 9**

Operating system overview-objectives and functions, Evolution of Operating System- Operating System Structure - System Calls- Processes – Process Concept, Inter-process Communication.

**UNIT V PROCESS MANAGEMENT 9**

CPU Scheduling – Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Threads Overview– The critical-section problem, Semaphores, Classical problems of synchronization, Critical regions.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 David A Patterson, John L Hennessy, "Computer Organization and Design: The Hardware/Software Interface", 5<sup>th</sup> Edition, Morgan Kaufmann / Elsevier.
- 2 Michael Manoochchri, "Introduction to Computer Organization and Operating Systems", 2<sup>nd</sup> Edition, CRC Press, 2018.

**REFERENCES:**

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- 1 Miles J Murdocca, Vincent P. Heuring, "Introduction to Computer Organization and Architecture: Principles and Parallels", 3<sup>rd</sup> Edition, Pearson Education, 2017.
- 2 John L Hennessey, David A Patterson, "Computer Architecture – A Quantitative Approach", 5<sup>th</sup> Edition, Morgan Kaufmann / Elsevier Publishers, 2017.
- 3 Timothy Williams, "Introduction to Computer Organization: ARM Assembly Language Using the Raspberry Pi", 1<sup>st</sup> Edition, CRC Press, 2017.

#### ONLINE REFERENCES:

- 1 <https://jntuh239529920.files.wordpress.com/2018/08/computer-organization-and-operating-systems.pdf>
- 2 <https://www.slideshare.net/slideshow/network-basicspdf/256103161>
- 3 <https://biet.ac.in/pdfs/coos.pdf>

#### COURSE OUTCOMES:

At the end of the course the students will able to

- C01 Explain the basics structure of computers, operations and instructions.
- C02 Describe arithmetic and logic unit, control unit
- C03 Summarize the various memory systems and I/O communication.
- C04 Design operating system functions, types, system calls.
- C05 Analyze Process and various scheduling algorithms.

#### CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C03	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C04	3	3	3	3	-	-	-	1	-	-	-	1	2	2
C05	3	3	2	2	-	-	-	1	-	-	-	1	2	2

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**P23BC06**

**COMPUTER NETWORKS**

**L T P C**  
**3 0 0 3**

**Prerequisites: Fundamentals of Networking**

**COURSE OBJECTIVES:**

- To understand networking concepts and basic communication model.
- To understand network architectures and components required for data communication.
- To analyze the function and design strategy of physical, data link, network layer and transport layer.

**UNIT I**

**NETWORK FUNDAMENTALS**

**9**

Uses of Networks – Categories of Networks -Communication model –Data transmission concepts and terminology – Protocol architecture – Protocols – OSI – TCP/IP – LAN Topology – Transmission media.

**UNIT II**

**DATA LINK LAYER**

**9**

Data link control - Flow Control – Error Detection and Error Correction - MAC – Ethernet, Token ring, Wireless LAN MAC – Blue Tooth – Bridges.

**UNIT III**

**NETWORK LAYER**

**9**

Network layer – Switching concepts – Circuit switching – Packet switching –IP – Datagrams – IP addresses- IPV6– ICMP – Routing Protocols – Distance Vector – Link State- BGP.

**UNIT IV**

**TRANSPORT LAYER**

**9**

Transport layer –service –Connection establishment – Flow control – Transmission control protocol – Congestion control and avoidance – User datagram protocol

**UNIT V**

**APPLICATIONS AND SECURITY**

**9**

Applications - DNS- SMTP – WWW –SNMP- Security –threats and services - DES- RSA.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

- 1 Larry L. Peterson & Bruce S. Davie, "Computer Networks – A systems Approach", 6<sup>th</sup> Edition, Morgan Kaufmann, 2021.
- 2 James F. Kurose, Keith W. Ross, "Computer Networking: A Top-down Approach", Pearson Education, Limited, 8<sup>th</sup> Edition, 2020.

**REFERENCES:**

- 1 Forouzan, "Data Communication and Networking", 6<sup>th</sup> Edition, Tata McGraw Hill, 2021.
- 2 William Stallings, "Data and Computer Communications", 10<sup>th</sup> Edition, Pearson Education, 2017.
- 3 Larry L Peterson & Bruce S. Davie, "Computer Networks – A systems Approach", 6<sup>th</sup> Edition, Morgan Kaufmann, 2021.

**ONLINE REFERENCES:**

- 1 <https://ncert.nic.in/textbook/pdf/lacs110.pdf>
- 2 <https://www.slideshare.net/slideshow/network-basicspdf/256103161>

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3 <https://archive.nptel.ac.in/courses/106/105/106105183/>

**COURSE OUTCOMES:**

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

- C01** Understand the basic concepts of networks.
- C02** Explain the components required to build different types of networks.
- C03** Describe the basic functionalities needed for data communication into layers
- C04** Apply the required functionality at each layer for given application.
- C05** Explain the working principles of various application protocols and fundamentals of security issues and services available.

**CO - PO - PSO MAPPING:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C02	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C03	2	2	1	1	-	-	-	1	-	-	-	1	2	2
C04	3	2	1	2	-	-	-	1	-	-	-	1	2	2
C05	2	2	1	1	-	-	-	1	-	-	-	1	2	2

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