

## **Scheme with Description**

### **Syllabus**

### **for**

### **B. Tech. in**

### **Computer Science and Engineering**

### **(Artificial Intelligence & Machine Learning)**

*Department of Computer Science and Engineering*

*Second Year With effect from the Academic Year 2025-26*

**Ramrao Adik Institute of Technology**

**Credit structure -Semester-III**


Course Category	Course Code	Course Name	Teaching Hours		Credits Assigned		
			TH	PR	TH	PR	Total
Programme Core Course	2413CAC3T1	Design and Analysis of Algorithms	3	--	3	--	3
	2413CAC3T2	Database Management System	3	--	3	--	3
	2413CAC3T3	Statistical Methods	3	--	3	--	3
Multidisciplinary Minor -I	2413CAU3T1	Embedded Systems	2	--	2	--	2
Open Elective I	2413CAG3T1	Human Resource Management	2	--	2	--	2
	2413CAG3T2	Emerging Trends in Technology					
	2413CAG3T3	Innovation and Creativity					
	2413CAG3T4	Accounting for Everyone					
Ability Enhancement Course	2413CAA3T1	Business English and Communication	2	--	2	--	2
Value Education Course	2413CAV3T1	Environmental Science	2	--	2	--	2
Vocational Skill Enhancement Course	2413CAS3L1	Skill Based Lab – I: OOP with Java	--	4	--	2	2
Programme Core Course Lab	2413CAC3L1	Design and Analysis of Algorithms Lab	--	2	--	1	1
	2413CAC3L2	Database Management System Lab	--	2	--	1	1
<b>Total</b>			<b>17</b>	<b>8</b>	<b>17</b>	<b>4</b>	<b>21</b>



**Evaluation scheme -Semester-III**

Course Category	Course Code	Course Name	Internal Assessment	Uni. Exam	Total
Programme Core Course	2413CAC3T1	Design and Analysis of Algorithms	50	100	150
	2413CAC3T2	Database Management System	50	100	150
	2413CAC3T3	Statistical Methods	50	100	150
Multidisciplinary Minor -I	2413CAU3T1	Embedded Systems	30	60	90
Open Elective I	2413CAG3T1	Human Resource Management	30	60	90
	2413CAG3T2	Emerging Trends in Technology			
	2413CAG3T3	Innovation and Creativity			
	2413CAG3T4	Accounting for Everyone			
Ability Enhancement Course	2413CAA3T1	Business English and Communication	30	60 <sup>#</sup>	90
Value Education Course	2413CAV3T1	Environmental Science	30	60 <sup>#</sup>	90
Vocational Skill Enhancement Course	2413CAS3L1	Skill Based Lab – I: OOP with Java	30	30	60
Programme Core Course Lab	2413CAC3L1	Design and Analysis of Algorithms Lab	30	30	60
	2413CAC3L2	Database Management System Lab	30	30	60
<b>Total</b>			<b>360</b>	<b>630</b>	<b>990</b>

# MCQ based examination.

 <div><b>D Y PATIL</b> DEEMED TO BE UNIVERSITY —RAMRAO ADIK— INSTITUTE OF TECHNOLOGY NAVI MUMBAI</div>			<b>B.TECH IN COMPUTER SCIENCE &amp; ENGINEERING (ARTIFICIAL INTELLIGENCE &amp; MACHINE LEARNING)</b>					<b>SECOND YEAR SEM- III</b>		
<b>Course Code</b>	<b>Course Name</b>	<b>Teaching Scheme (Contact Hours 39)</b>					<b>Credits Assigned</b>			
		Theory			Practical		Theory		Total	
2413CAC3T1	Design and Analysis of Algorithms	03			--		03		03	
		Theory Evaluation Scheme (Marks)								
		Internal Assessment (50)						End Sem. Exam	End Sem. Exam Hrs.	Total
		Best 2 (20)			(30)					
		CA1	CA2	CA3	Assignment / Tutorial	Quiz / Seminar	Open Book Test / Surprise Test / Capstone Project			
		10	10	10	10	10	10			
								100	03	150

- **Prerequisite:**

2413FYC1T1 Structured Programming

2413FYC2T1 Data structure

- **Course Description:**

This course enables to understand fundamental techniques to design and analyze efficient algorithms for various applications. The course covers concepts of algorithms which are essential for operations like searching, sorting, selection, pattern matching & recursion, and various algorithmic strategies like greedy, divide and conquer, dynamic programming and backtracking approach with analysis of computational complexity.

- **Course Objectives:**

- To make students understand the basic principles of algorithm design.
- To solve problems using various strategies.
- To demonstrate performance of algorithms with respect to time and space complexity.
- To teach students the important algorithm design paradigms and how they can be used to solve various real-world problems.

- **Course Outcomes:** After completion of this course, learners will be able to:

CO1: Analyze the running time and space complexity of algorithms.

CO2: Apply and analyze complexity of divide and conquer strategy and greedy strategy.

CO3: Implement and evaluate the complexity of the dynamic programming strategy.

CO4: Understand and apply backtracking, branch and bound strategy.

CO5: Explore string-matching techniques to deal with some hard problems.

CO6: Describe the classes P, NP, NP-Complete and differentiate polynomial and non-polynomial problems.


Module No.	Detailed Content	Hrs (39)	CO
1	<b>Introduction:</b> Analysis of algorithms, Types of complexity, Asymptotic Notations, Recurrences. Methods for finding complexity of recursive algorithms, Analysis of selection and insertion sort algorithms.	6	CO1
2	<b>Divide and Conquer:</b> Analysis of Binary search, Quick sort, Merge Sort algorithms. <b>Greedy Design Strategies:</b> Elements of Greedy Strategy, Minimum cost spanning tree algorithms, Dijkstra's Shortest Path Algorithm, Job Sequencing with deadline, Knapsack Problem.	8	CO2
3	<b>Dynamic Programming Approach:</b> Elements of Dynamic programming, Multistage graphs, Bellman ford single source shortest path algorithm, Floyd Warshall's all pair shortest path algorithm, Travelling salesman problem, 0-1 Knapsack Problem, LCS.	8	CO3
4	<b>Backtracking and Branch-and- bound:</b> N-queens problem, Sum of subsets problem, Graph coloring, Traveling Salesperson Problem, 15 Puzzle Problem.	6	CO4
5	<b>String Matching Algorithms:</b> The naive string-matching algorithm, Rabin Karp algorithm, String Matching with finite automata, Knuth-Morris-Pratt algorithm.	6	CO5
6	<b>Introduction to NP- Completeness:</b> P, NP, and NP-complete Problems. Vertex Cover, Hamiltonian Cycle and Traveling Salesman Problems.	5	CO6

#### Text books:

1. Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C., *Introduction to algorithms*, IV<sup>th</sup> Edition, MIT press, Cambridge, 2022.
2. Ellis Horowitz, Sartaj Sahni, S. Rajsekaran, *Fundamentals of Computer algorithms*, II<sup>nd</sup> Edition, University science Press, New York, 2008.

#### Reference books:

1. Sedgewick, R., *An introduction to the analysis of algorithms*, II<sup>nd</sup> Edition, Pearson Education India, Delhi, 2013.
2. Basu, S.K., *Design methods and analysis of algorithms*, II<sup>nd</sup> Edition, PHI Learning Pvt. Ltd, Delhi, 2013.
3. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, *Algorithms*, I<sup>st</sup> Edition, Tata McGraw- Hill Edition, India, 2006.
4. Goodrich, M.T. and Tamassia, R., *Algorithm design and applications*, I<sup>st</sup> Edition, New Jersey, 2014.

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<b>Course Code</b>	<b>Course Name</b>	<b>Teaching Scheme (Contact Hours 39)</b>					<b>Credits Assigned</b>			
		Theory			Practical		Theory		Total	
2413CAC3T2	Database Management System	03			--		03		03	
		<b>Theory Evaluation Scheme (Marks)</b>								
		<b>Internal Assessment (50)</b>						End Sem. Exam	End Sem. Exam Hrs.	Total
		<b>Best 2 (20)</b>			<b>(30)</b>					
		CA1	CA2	CA3	Assignment / Tutorial	Quiz / Seminar	Open Book Test / Surprise Test / Capstone Project			
		10	10	10	10	10	10			
								100	03	150

- **Prerequisite:**  
2413FYB1T1 Engineering Mathematics-I
- **Course Description:**  
The DBMS subject covers database concepts, models, and management techniques, including SQL, normalization, and transaction control. It focuses on efficiently storing, retrieving, and maintaining data while ensuring security and integrity.
- **Course Objectives:**
  - Learn and practice data modelling using the entity-relationship and developing database designs.
  - Understand the use of Structured Query Language (SQL) and learn PL/SQL.
  - Apply normalization techniques to normalize the database.
  - Understand the needs of database processing and learn techniques for controlling the consequences of concurrent data access.
- **Course Outcomes:** After completion of this course, learners will be able to:
  - CO1: Understand the fundamentals of database systems and design ER for the real-life problem.
  - CO2: Convert conceptual model to relational model and formulate relational algebra queries.
  - CO3: Design and querying database using SQL.
  - CO4: Analyze and apply concept of normalization to relational database design.
  - CO5: Implement triggers, stored procedures and functions in PL/SQL.
  - CO6: Understand the concept of transactions, concurrency, recovery management, and query optimization

<b>Module No.</b>	<b>Detailed Content</b>	<b>Hrs (39)</b>	<b>CO</b>
<b>1</b>	<b>Database System Concepts and ER Model</b> Introduction, Characteristics of Databases, File system v/s Database system, Data abstraction and Data Independence, DBMS system architecture, Database Administrator (DBA), Types of Databases, Data Models, The Entity Relationship (ER) Model, Entity Types, Entity Sets, Types of Attributes and Keys, Relationship Types, Relationship constraints, Generalization, Specialization and Aggregation, Extended Entity-Relationship (EER) Model	7	<b>CO1</b>
<b>2</b>	<b>Relational Model and Relational Algebra</b> Introduction to Relational Model, Relational Database Schemas, Concept of Keys, Mapping ER and EER Model to Relational Model, Introduction to Relational Algebra, Relational Algebra operations, Unary/Binary Relational Operations, Set operations, Relational Algebra Queries	6	<b>CO2</b>
<b>3</b>	<b>Structured Query Language (SQL)</b> Overview of SQL, Data Definition Commands, Data Manipulation Commands, Data Control commands, Transaction Control Commands, Set operations, String operations, Aggregate Functions, Views, Nested and Complex Queries, Integrity constraints in SQL and Joins.	8	<b>CO3</b>
<b>4</b>	<b>Relational Database Design</b> Design guidelines for relational Schema, Functional Dependencies, Closure, need for normalization, Definition of Normal Forms- 1NF, 2NF, 3NF & The Boyce-Codd Normal Form (BCNF). Lossy and lossless decomposition, dependency preserving decomposition.	5	<b>CO4</b>
<b>5</b>	<b>Procedural Language/SQL</b> Procedural Language/SQL Advantages of PL/SQL, Main Features of PL/SQL, Architecture of PL/SQL. Fundamentals of PL/SQL: Character Sets, Lexical Units, Declarations, References to Identifiers, Scope and Visibility of Identifiers, Assigning Values to Variables, Expressions, Creating stored procedures, Functions, Cursor and Triggers.	5	<b>CO5</b>
<b>6</b>	<b>Transactions Management and Query processing</b> Transaction States, ACID Properties, Concurrent Executions, Serializability – Conflict and View, Concurrency Control: Lock-based-protocols, Recovery System-Shadow Paging, Overview of Query Processing and Optimization.	8	<b>CO6</b>

**Text books:**

1. A. Silberschatz, H. F. Korth, and S. Sudarshan, *Database System Concepts*, VII ed. New York, USA: McGraw-Hill, 2019.
2. R. Elmasri, Navathe, *Fundamentals of Database Systems*, VII ed. New Delhi, India: Pearson Education, 2017.

**Reference books:**

1. M. L. Gillenson, P. Ponniah, A. Kriegel, B. M. Trukhnov, A. G. Taylor, and G. Powell, *Introduction to Database Management – Project Manual*, I ed. Hoboken, USA: Wiley, 2007.
2. P. S. Deshpande, *SQL and PL/SQL for Oracle 10g Black Book*, I ed. New Delhi, India: Dreamtech Press, 2007.
3. G. K. Gupta, *Database Management Systems*, New Delhi, India: McGraw-Hill, 2012.
4. B. R. Desai, *Database Management Systems*, XI ed. New York, NY, USA: Galgotia Publications, 1997






Module No.	Detailed Content	Hrs (39)	CO
1	<b>Correlation Analysis</b> Definition and types of correlation, methods of measuring correlation scatter diagram, Karl Pearson's coefficient of correlation and Spearman's rank correlation.	06	CO1
2	<b>Linear Regression</b> Introduction to regression analysis, simple linear regression, regression coefficients and properties, lines of regressions.	07	CO2
3	<b>Sampling and Estimation</b> Population and sample, probability and non-probability sampling, types. Estimator and its properties, point and interval estimation.	07	CO3
4	<b>Significance Tests</b> Null and alternative hypotheses, type I and type II errors, testing of hypothesis, parametric test: z-test, t-test and F-test	08	CO4
5	<b>Non- parametric Tests</b> Non- parametric tests, chi-square test, sign test for population median, analysis of variance (ANOVA), post-hoc test: Tuckey's HSD	06	CO5
6	<b>Dimensionality Reduction</b> Review of Matrix algebra, eigenvalues and eigenvectors, properties, Spectral Decomposition, Positive Definite matrices, SVD, PCA, applications.	05	CO6

#### Text books:

1. Dr. P. N. Arora, Sumeet Arora, S. Arora, Amit Arora, *Comprehensive Statistical Methods*, IV<sup>th</sup> Edition, New Delhi, India, S Chand and Company Limited, 2021.
2. G James, D. Witten, T Hastie, and R. Tibshirani, *An Introduction to Statistical Learning: with Applications in R*, I<sup>st</sup> Edition, New York, USA, Springer Publishing House, 2013.

#### Reference books:

1. S. P. Gupta, *Statistical Methods*, XLVI<sup>th</sup> Edition, New Delhi, India, Sultan Chand & Sons, 2021.
2. B. L. Agarwal, *Basic Statistics*, VI<sup>th</sup> Edition, New Delhi, India, New Age International Private Limited, 2021.
3. Johnson and Wichern, *Applied Multivariate Statistical Analysis*, VI<sup>th</sup> Edition, New Delhi, India, Pearson Education, 2015.
4. Gilbert Strang, *Introduction to Linear Algebra*, V<sup>th</sup> Edition, Wellesley, USA, Wellesley-Cambridge Press, 2016.

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<b>Course Code</b>	<b>Course Name</b>	<b>Teaching Scheme (Contact Hours 26)</b>			<b>Credits Assigned</b>				
		Theory		Practical	Theory		Total		
2413CAU3T1	Embedded Systems	02		--		02		<b>02</b>	
		<b>Theory Evaluation Scheme (Marks)</b>							
		Internal Assessment (30)					End Sem. Exam	End Sem. Exam Hrs.	Total
		Best 1 (10)		(20)					
		CA1	CA2	Assignment / Tutorial	Quiz / Seminar	Open Book Test / Surprise Test /Capstone Project			
		10	10	10	05	05	<b>60</b>	02	<b>90</b>

- **Prerequisite:**

Basic knowledge of electronics and programming

- **Course Description:**

This content covers digital systems and introduces embedded systems, emphasizing their distinctions from general-purpose computers, classifications, applications, and essential components such as microcontrollers, ASICs, RISC, and CISC architectures. It explores the 8051 microcontroller, including its architecture, addressing modes, assembly and C programming, and peripheral interfacing with devices like LCDs and motors. Additionally, it provides insights into ARM processors and advanced ARM architectures.

- **Course Objectives:**

- To establish a fundamental understanding of digital systems.
- To provide an overview of embedded systems and embedded core concepts.
- To introduce the fundamentals of the 8051 microcontroller and its assembly language programming.
- To develop proficiency in assembly and high-level programming while exploring the integrated hardware of the 8051 microcontrollers.

- **Course Outcomes:** After completion of this course, learners will be able to:

CO1: Understand number systems, logic gates, and design basic combinational and sequential circuits.

CO2: Explain embedded systems, their classifications, applications, and key architectural concepts.

CO3: Analyze 8051 architecture and apply assembly programming concepts.

CO4: Develop programs using I/O ports, timers, serial communication, and interrupts.


CO5: Design and implement 8051-based peripheral interfacing and real-world embedded applications.

CO6: Explain ARM architecture, register operations, pipelining, and evaluate Cortex processor architecture.

<b>Module No.</b>	<b>Detailed Content</b>	<b>Hrs (26)</b>	<b>CO</b>
<b>1</b>	<b>Overview of Digital Systems</b> Number Systems: Introduction to Binary, Octal, Decimal, and Hexadecimal number systems, conversion methods. <b>Logic Gates:</b> Representation of basic logic gates with symbols and truth tables. Circuit diagrams and working principles of Adders and Multiplexers, Demultiplexers, R-S Flip-Flops, and D Flip-Flops.	<b>5</b>	<b>CO1</b>
<b>2</b>	<b>Introduction to Embedded systems</b> Embedded Systems and general-purpose computer systems, Comparison of microprocessor and microcontroller, classifications, applications. ASIC, RISC and CISC architecture.	<b>4</b>	<b>CO2</b>
<b>3</b>	<b>MCS-51 microcontroller</b> Family and Architecture of 8051, Introduction to Assembly language programming, call, loop, jump instructions.	<b>4</b>	<b>CO3</b>
<b>4</b>	<b>8051 Addressing Modes &amp; Programming</b> I/O port programming, Addressing modes, Arithmetic and Logic Instructions and programs. Timer/ counter, Concepts of Serial Communication, RS232, 8051 interrupts.	<b>5</b>	<b>CO4</b>
<b>5</b>	<b>8051 Peripheral Interfacing</b> Interfacing 8051 with peripherals such as a keyboard, seven-segment display, LCD, DC motor, and stepper motor. Case studies on embedded systems: digital cameras and washing machines.	<b>4</b>	<b>CO5</b>
<b>6</b>	<b>Introduction to ARM</b> ARM Architecture: Overview of architecture, register set, operating modes, and CPSR, pipelining in ARM processors. <b>Advanced ARM Processors:</b> Introduction to Cortex processor core and its architecture.	<b>4</b>	<b>CO6</b>

#### **Text books:**

1. Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6e, 2018.
2. Digital Fundamentals, 11th Edition by Thomas L. Floyd, Pearson, 2017.
3. The 8051 Microcontroller and Embedded systems by Mazidi M.A, Pearson Education, Second edition, 2007.
4. The 8051 Microcontroller by Kenneth Ayala, Thomson Delmar Learning, Third Edition, 2007.
5. Embedded Systems: Architecture, Programming and Design by Rajkamal, McGraw Hill Education (India) Private Limited, New Delhi, Third Edition, 2017.
6. Embedded Systems Design by Steve Heath, Newness publication, Second edition, 2003.
7. Embedded Software Primer by David Simon, Pearson Education, 2002.
8. Cortex-M4 Devices Generic User Guide, 2011.
9. Embedded System: Real-Time Interfacing to ARM Cortex-M Microcontrollers by Jonathan W. Valvano, Volume-2, Fourth edition, 2014.
10. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012

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<b>Course Code</b>	<b>Course Name</b>	<b>Teaching Scheme (Contact Hours 26)</b>				<b>Credits Assigned</b>			
		Theory		Practical		Theory	Total		
2413CAG3T1	Human Resource Management	02		--		02	<b>02</b>		
		<b>Theory Evaluation Scheme (Marks)</b>							
		Internal Assessment (30)					End Sem. Exam	End Sem. Exam Hrs.	Total
		Best 1 (10)		(20)					
		CA1	CA2	Assignment / Tutorial	Quiz / Seminar	Open Book Test / Surprise Test /Capstone Project			
		10	10	10	05	05	<b>60</b>	02	<b>90</b>

- **Prerequisite:**

Basic understanding of business management principles and organizational behavior

- **Course Description:**

This course provides a comprehensive understanding of Human Resource Management (HRM) by exploring its core philosophy, strategic alignment with business goals, and operational functions. The learners will examine the collaboration between HR and line managers in workforce planning, the role of HRIS and payroll systems, and strategies for employee retention, training, and staffing. By the end of this course, participants will gain insights into HRM concepts, functions, strategic management, human resource planning, and HR practices in the service sector, equipping them with the knowledge to navigate modern HR challenges effectively.

- **Course Objectives:**

- To understand the philosophy behind HRM and how it aligns with business objectives
- To explore the collaboration between line managers and HR in workforce management
- To analyze the role of HRIS and payroll systems in managing workforce data
- To develop action plans for employee retention, training, redeployment, and staffing
- To examine the impact of flexible work arrangements on HR policies and employee performance

- **Course Outcomes:** After completion of this course, learners will be able to:

- CO1: Study the basic concept and challenges in Human resource management.
- CO2: Explore the roles and responsibilities of HRM.
- CO3: Understand the functions and activities of HR.
- CO4: Gain core knowledge of strategic management of HR.
- CO5: Acquire knowledge of human resource planning.
- CO6: Know and discover HRM in service sector.


<b>Module No.</b>	<b>Detailed Content</b>	<b>Hrs (26)</b>	<b>CO</b>
<b>1</b>	<b>Human Resource Management</b> Evolution and Importance of HRM in Organizations, Challenges, Understanding HR Philosophy: Employee-Centric vs. Business-Centric Approaches, HR Policies, Standard Operating Practices & Practices in HR Policy Implementation	<b>4</b>	<b>CO1</b>
<b>2</b>	<b>Human Resource System Design</b> HR Profession, and HR Department, Line Management Responsibility in HRM, Measuring HR, Human resources accounting and audit, Human resource information system	<b>4</b>	<b>CO2</b>
<b>3</b>	<b>Functional Areas of HRM</b> Introduction to Recruitment and Staffing, Recruitment and staffing benefits, compensation, employee relations and HR compliance, Organizational design, training and development, Human resource information systems (H.R.I.S.) and payroll Technology	<b>5</b>	<b>CO3</b>
<b>4</b>	<b>Human Resource Planning</b> Introduction to HR Demand Forecasting, Action Plans – Employee Retention & Training, Redeployment & Staffing Strategies, Succession Planning & Leadership Development	<b>4</b>	<b>CO4</b>
<b>5</b>	<b>Strategic Management of Human Resources</b> Introduction to Strategic Human Resource Management, Relationship Between HR Strategy and Corporate Strategy, HR as a Factor of Competitive Advantage, Managing Diversity in the Workplace, HR Strategy Implementation and Change Management, Future Trends in Strategic HRM	<b>5</b>	<b>CO5</b>
<b>6</b>	<b>Human Resource Management in Service Sector</b> Managing Customer-Employee Interaction, Employee Empowerment and Customer Satisfaction, Service Failure and Customer Recovery – The Role of Communication and Training, Frontline Workers vs. Backend Support – Similarities and Differences.	<b>4</b>	<b>CO6</b>

**Text books:**

1. Garry Dessler & Varkkey, Human Resource Management, Pearson, New Delhi, 2009.
2. Alan Price, Human Resource Management, Cengage Learning, Newdelhi, 2007.
3. Pravin Durai, Human Resource Mangement, Pearson, New Delhi, 2010.
4. Snell, Bohlander & Vohra, Human Resources Management, Cengage, New Delhi, 2010.

**Reference books:**

1. Venkata Ratnam C. S. & Srivatsava B. K.,Personnel Management And Human Resources, Tata Mc-Graw Hill, New Delhi.
2. Aswathappa, Human Resource Mangement, Tata Mcgraw Hill, Newdelhi, 2010.

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<b>Course Code</b>	<b>Course Name</b>	<b>Teaching Scheme (Contact Hours 26)</b>			<b>Credits Assigned</b>				
		Theory		Practical	Theory		Total		
2413CAA3T2	Emerging Trends in Technology	02		--		02		<b>02</b>	
		<b>Theory Evaluation Scheme (Marks)</b>							
		Internal Assessment (30)					End Sem. Exam	End Sem. Exam Hrs.	Total
		Best 1 (10)		(20)					
		CA1	CA2	Assignment / Tutorial	Quiz / Seminar	Open Book Test / Surprise Test /Capstone Project			
		10	10	10	05	05	<b>60</b>	02	<b>90</b>

- **Prerequisite:**

No prior knowledge of emerging trends in technology is required.

- **Course Description:**

This course provides an introduction to the impact of contemporary technological trends upon the art and science of teaching and learning curricula. It explores the integration of various smart technologies within educational frameworks, with particular emphasis on their influence upon the student experience and the facilitation of pedagogical practices. The subject matter encompasses a detailed study of collaborative technologies within virtual education environments, the application of game-based learning methodologies, the implementation of augmented reality systems, and the utilization of wearable technologies. Furthermore, the course will undertake a thorough examination of the benefits and limitations inherent in virtual learning modalities.

- **Course Objectives:**

- Learn the latest technological advancements in education as more online and virtual classroom teaching is gaining popularity.
- Learn how collaboration is facilitated by virtual education.

- **Course Outcomes:** After completion of this course, learners will be able to:


- CO1: Define educational technology's role in supporting the virtual environment.
- CO2: Identify and evaluate existing and emerging technologies for virtual course instruction or curriculum development.
- CO3: Use collaborative learning tools to design and assess learning activities.
- CO4: Use game-based strategies to deepen student engagement in virtual courses.
- CO5: Research, evaluate, and employ open content in virtual education.
- CO6: Debate the role of MOOCs in virtual education

<b>Module No.</b>	<b>Detailed Content</b>	<b>Hrs (26)</b>	<b>CO</b>
<b>1</b>	The Role of Educational Technology in Virtual Education: The role of technology in virtual education, evaluate technologies for use, and how to implement technology in the virtual classroom. Problems related to virtual trends and technology.	<b>4</b>	<b>CO1</b>
<b>2</b>	Collaborative Technologies in Virtual Education: Collaborative learning technologies and evaluate learning management systems. Review of asynchronous and synchronous technologies for application virtual education.	<b>4</b>	<b>CO2</b>
<b>3</b>	Game-based Learning vs Gamification, examples of digital game-based learning, DGBL platforms such as prodigy.	<b>5</b>	<b>CO3</b>
<b>4</b>	Augmented reality, and wearable technologies: In-depth learning framework, lesson design maps, learning experience model to implement VR lessons.	<b>4</b>	<b>CO4</b>
<b>5</b>	Open Content in Virtual Education: compare different types of open educational content.	<b>5</b>	<b>CO5</b>
<b>6</b>	Exploring the Benefits and limitations of virtual learning. Learning life skills through gaming for children with autism disorder.	<b>4</b>	<b>CO6</b>

**Text books:**

1. Chris Bailey, Digital Education and Learning, Palgrave Macmillan, 2021.
2. Brooke B. Eisenbach, Paula Greathouse, The Online Classroom: Resources for Effective Middle Level Virtual Education, Information Age Publishing, 2018



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<b>Course Code</b>	<b>Course Name</b>	<b>Teaching Scheme (Contact Hours 26)</b>				<b>Credits Assigned</b>			
		Theory		Practical		Theory		Total	
2413CAG3T3	Innovation and Creativity	02		--		02		<b>02</b>	
		<b>Theory Evaluation Scheme (Marks)</b>							
		Internal Assessment (30)					End Sem. Exam	End Sem. Exam Hrs.	Total
		Best 1 (10)		(20)					
		CA1	CA2	Assignment / Tutorial	Quiz / Seminar	Open Book Test / Surprise Test /Capstone Project			
		10	10	10	05	05	<b>60</b>	02	<b>90</b>

- **Prerequisite:**

Critical Thinking

- **Course Description:**

This course explores the principles and processes of innovation and creativity in various fields. It focuses on developing creative problem-solving skills, fostering an innovative mindset, and understanding how new ideas are generated, evaluated, and implemented. Students will learn about design thinking, brainstorming techniques, and the role of innovation in entrepreneurship, technology, and business.

- **Course Objectives:**

- Understand concepts of creativity, invention, and innovation.
- Develop understanding of the creative process and models.
- Enhance creative potential and overcome barriers.
- Apply ideation techniques to generate and refine ideas.
- Understand innovation management and intellectual property.
- Explore micro and macro perspectives of innovation.

- **Course Outcomes:** After completion of this course, learners will be able to:

CO1: Explain creativity, invention, and innovation in a knowledge-driven economy.

CO2: Identify and overcome barriers to creativity.

CO3: Apply creativity enhancement techniques and teamwork strategies.

CO4: Implement ideation techniques and evaluate ideas.

CO5: Understand innovation types, management frameworks, and IPR.

CO6: Analyze innovation ecosystems and future trends.

<b>Module No.</b>	<b>Detailed Content</b>	<b>Hrs (26)</b>	<b>CO</b>
<b>1</b>	<b>Introduction to Creativity &amp; Innovation</b> Introduction to concepts of Creativity, Invention, and Innovation, Relationship Between Creativity, Invention, and Innovation, Importance of Creativity & Innovation in the knowledge-driven economy, Components of the Creative Process, Models Representing the Creative Process: Wallas' Four-Stage Model of the Creative Process, Graham Wallas' Five-Stage Model (Preparation, Incubation, Intimation, Illumination, Verification), Design Thinking Process (Empathize, Define, Ideate, Prototype, Test)	<b>4</b>	<b>CO1</b>
<b>2</b>	<b>Unlocking Creative Potential</b> Understanding individual creative potential, Barriers to creativity: Internal barriers: Fear of failure, self-doubt, rigid thinking, External barriers: Societal norms, workplace constraints, lack of resources, Overcoming blockages and developing a creative mindset, Mindset shifts: Growth mindset, embracing uncertainty, Techniques: Meditation, observation exercises, creative journaling, Myths and Misconceptions About Creativity, Cultivating an Innovative Mindset	<b>5</b>	<b>CO2</b>
<b>3</b>	<b>Enhancing Creativity &amp; Team Synergy</b> Techniques to enhance creativity in individuals, Dealing with external factors that hinder creativity, Importance of collaborative innovation and teamwork: The Role of Teamwork in Creativity, Strategies for Encouraging Team, Creativity, Encouraging open communication and idea-sharing, Role of collaborative environments in fostering creativity: Harnessing creativity from nature.	<b>4</b>	<b>CO3</b>
<b>4</b>	<b>Ideation Techniques &amp; Strategies</b> Introduction to Ideation, Definition and importance of ideation, Role of ideation in innovation, Stages of ideation, Idea Generation Techniques, Brainstorming Techniques (SCAMPER, Mind Mapping, Reverse Thinking), Idea Selection & Evaluation (Feasibility, Desirability, Viability), From Idea to Prototype: Concept validation & proof of concept, Review of idea/product & market feasibility	<b>5</b>	<b>CO4</b>
<b>5</b>	<b>Introduction to Innovation &amp; Its Management</b> Difference Between Innovation & Invention, Nature of Innovation, Types of Innovation: Incremental vs. Radical Innovation, Product vs. Process Innovation, Sustaining vs. Disruptive Innovation, Sources of Innovation, Managing Innovation in Organizations: Innovation Management Frameworks, Role of Leadership in Innovation, Challenges in Implementing Innovation, Theories of Innovation & New Product Development: Introduction to IP Rights: Patents, Trademarks, Copyrights, and Trade Secrets, Importance of Intellectual Property in Innovation Management, Types of IPR – Patents, Trademarks, Copyrights, and Trade Secrets, geographical indications	<b>4</b>	<b>CO5</b>
<b>6</b>	<b>Micro and Macro Perspectives of Innovation</b> Systems Approach to Innovation: Understanding Innovation as a System, Interconnections between technology, business, and society, Innovation Ecosystem: Key players (Startups, Corporations, Governments, Academia, Investors), Micro Perspective of Innovation: Factors Affecting Innovation at the Organizational Level, Leadership & Corporate Culture for Innovation, Barriers	<b>4</b>	<b>CO6</b>


	to Innovation within Organizations, Macro Perspective of Innovation National Innovation Systems (NIS) & Government Policies, Innovation in Emerging Economies vs. Developed Economies, Role of Public & Private Sectors in Fostering Innovation, Future Trends & Global Perspectives on Innovation, AI & Digital Transformation in Innovation, Sustainability & Green Innovation, Case Studies of Large-Scale Innovation Initiatives		
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### **Text books:**

1. Mihaly Csikszentmihalyi, Creativity: The Psychology of Discovery and Invention.
2. Pradip N Khandwalla, Lifelong Creativity, An Unending Quest, Tata McGraw Hill, 2004.
3. Vinnie Jauhari, Sudanshu Bhushan, Innovation Management, Oxford Higher Education, 2014.

### **Reference books:**

1. A.DaleTimpe, Creativity, Jaico Publishing House, 2003.
5. Brian Clegg, Paul Birch, Creativity, Kogan Page, 2009.
2. Steal Like an Artist: 10 Things Nobody Told You About Being Creative – Austin Kleon
3. P. N. Rastogi, Managing Creativity for Corporate Excellence, Macmillan 2009.
4. Innovation Management, C. S. G. Krishnamacharyulu, R. Lalitha, Himalaya Publishing House, 2010.
5. The Innovator’s Dilemma: When New Technologies Cause Great Firms to Fail – Clayton M. Christensen

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<b>Course Code</b>	<b>Course Name</b>	<b>Teaching Scheme (Contact Hours 26)</b>				<b>Credits Assigned</b>			
		Theory		Practical		Theory	Total		
2413CAG3T4	Accounting for Everyone	02		--		02	02		
		Theory Evaluation Scheme (Marks)							
		Internal Assessment (30)					End Sem. Exam	End Sem. Exam Hrs.	Total
		Best 1 (10)		(20)					
		CA1	CA2	Assignment / Tutorial	Quiz / Seminar	Open Book Test / Surprise Test /Capstone Project			
		10	10	10	05	05	60	02	90

- **Prerequisite:**

No prior knowledge of accounting is required

- **Course Description:**

This course provides a fundamental understanding of financial accounting principles and practices, making it accessible to individuals from all backgrounds. It equips learners with the skills to interpret financial information and understand essential accounting concepts.

- **Course Objectives:**

- Introduce financial accounting to learners with no prior commerce background.
- Develop foundational skills for recording and managing various financial transactions.
- Enable learner to analyze and interpret basic financial statements effectively.
- 

- **Course Outcomes:** After completion of this course, learners will be able to:

- CO1: Demonstrate an understanding of fundamental accounting terms and their relevance in financial reporting and business operations.
- CO2: Record financial transactions using the double-entry system and prepare ledgers, cash books, and bank reconciliation statements.
- CO3: Prepare financial statements, including Trial Balance, Profit & Loss Account, Balance Sheet, and Cash Flow Statement, manually and using software.
- CO4: Utilize accounting software to manage financial records, generate reports, and perform data backup and restoration.
- CO5: Interpret key company account terms and analyze financial statements and annual reports.
- CO6: Analyze management reports, including governance, CSR, business responsibility, and corporate governance reports

<b>Module No.</b>	<b>Detailed Content</b>	<b>Hrs (26)</b>	<b>CO</b>
<b>1</b>	<b>Introduction to Accounting</b> Meaning, Importance and Need, Its objectives and relevance to business establishments and other organizations, and individuals. Accounting information: meaning, users and utilities, sources of accounting information. Some Basic Terms –Transaction, Account, Asset, Liability, Capital, Expenditure & Expense, Income, Revenue, Gain, Profit, Surplus, Loss, Deficit. Debit, Credit, Accounting Year, Financial Year.	<b>5</b>	<b>CO1</b>
<b>2</b>	<b>Transactions and Recording of Transactions</b> Features of recordable transactions and events, Basis of recording – vouchers and another basis. Recording of transactions: Personal account, Real Account and Nominal Account; Rules for Debit and Credit; Double Entry System, journalizing transactions; Preparation of Ledger, Cash Book including bank transactions and Bank Reconciliation Statement.	<b>4</b>	<b>CO2</b>
<b>3</b>	<b>Preparation of Financial Statements</b> Fundamental Accounting Equation; Preparation of Trial Balance; Concept of revenue and Capital; Preparation of Trading and Profit & Loss Account, Balance Sheet and Cash Flow Statement manually and using appropriate software.	<b>4</b>	<b>CO3</b>
<b>4</b>	<b>Computerized Accounting Systems</b> Computerized Accounts by using any popular accounting software: Creating a Company; Configure and Features settings; Creating Accounting Ledgers and Groups; Creating Stock Items and Groups; Vouchers Entry; Generating Reports - Cash Book, Ledger Accounts, Trial Balance, Profit and Loss Account, Balance Sheet, Cash Flow Statement. Selecting and shutting a Company; Backup and Restore data of a Company.	<b>4</b>	<b>CO4</b>
<b>5</b>	<b>Company Accounts</b> Explanation of certain terms: Public Limited Company, Private Limited Company, Share, Share Capital, Shareholder, Board of Directors, Stock Exchange, Listed Company, Share Price, Sensex - BSE, NSE; Annual report, etc. Contents and disclosures in Annual Report, Company Balance Sheet and Statement of Profit and Loss. Content Analysis based on annual report including textual analysis.	<b>5</b>	<b>CO5</b>
<b>6</b>	<b>Management Reports</b> Reports on Management Review and Governance; Report of Board of Directors - Management discussion analysis- Annual Report on CSR – Business responsibility report – Corporate governance report – Secretarial audit report.	<b>4</b>	<b>CO6</b>


**It is desirable that learners be required to:**

1. Download annual reports of business Organizations from the websites and go through the contents of the annual report and present the salient features of the annual report using some ratios and content analysis including textual analysis.
2. Prepare bank reconciliation statement from the individual pass books.
3. Prepare Trading and Profit & Loss Account, Balance Sheet, and Cash Flow Statement collecting necessary data from small business firms.

4. Prepare financial statements using appropriate software.

**Text books:**

1. Hatfield, L. (2019). Accounting Basics. Amazon Digital Services LLC. Horngren.
2. C. T., Sundem, G. L., Elliott, J. A., & Philbrick, D. (2013). Introduction to Financial Accounting. London: Pearson Education.
3. Siddiqui, S. A. (2008). Book Keeping & Accountancy. New Delhi: Laxmi Publications Pvt. Ltd.
4. Sehgal, D. (2014). Financial Accounting. New Delhi: Vikas Publishing House Pvt. Ltd.
5. Tulsian, P. C. (2007). Financial Accounting. New Delhi: Tata McGraw Hill Publishing Co. Ltd.
6. Mukharji, A., & Hanif, M. (2015). Financial Accounting. New Delhi: Tata McGraw Hill Publishing Co. Ltd.
7. Maheshwari, S. N., Maheshwari, S. K., & Maheshwari, S. K. (2018). Financial Accounting. New Delhi: Vikas Publishing House Pvt. Ltd.
8. Mukherjee, S., & Mukherjee, A. K. (2015). Financial Accounting. Oxford: Oxford University Press.
9. Jain, S. P., & Narang, K. L. (2014). Financial Accounting. New Delhi: Kalyani Publishers.
10. Gupta, R. L., & Radhaswamy, M. (2014). Financial Accounting. New Delhi: S. Chand Publishing.
11. Lal, J., & Srivastava, S. (2012). Financial Accounting Text & Problems. Mumbai: Himalaya Publishing House.
12. Monga, J. R. (2017). Financial Accounting: Concepts and Applications. New Delhi: Mayur Paperback Publishing.
13. Goyal, B. K., & Tiwari, H. N. (2019). Financial Accounting. New Delhi: Taxmann Publication.

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Course Code	Course Name	Teaching Scheme (Contact Hours 26)				Credits Assigned			
		Theory		Practical		Theory	Total		
2413CAA3T1	Business English and Communication	02		--		02	<b>02</b>		
		Theory Evaluation Scheme (Marks)							
		Internal Assessment (30)					End Sem. Exam	End Sem. Exam Hrs.	Total
		Best 1 (10)		(20)					
		CA1	CA2	Assignment / Tutorial	Quiz / Seminar	Open Book Test / Surprise Test /Capstone Project			
		10	10	10	05	05	<b>60</b>	02	<b>90</b>

• **Course Description:**

This course covers essential professional skills, including report writing, business proposals, interview preparation, resume writing, and effective communication. It also focuses on managing meetings, delivering presentations, and developing interpersonal and business etiquette skills.

• **Course Objectives:**

- Discern and develop an effective style of writing important technical/business documents.
- Investigate possible resources and plan a successful job campaign.
- Analyze personal traits, interests, values, aptitudes and skills.
- Understand the dynamics of professional communication required for career enhancement.
- Develop creative and critical thinking required for effective workplace communication.
- Understand what it means to act with integrity and have a personal code of ethics for regulating organizational behavior.

• **Course Outcomes:** After completion of this course, learners will be able to:

CO1: Plan and prepare effective business/ technical documents which will in turn provide solid foundation for future managerial roles.

CO2: Gain expertise in preparing job search documents meeting the industry trends, and become adept in facing interviews successfully.

CO3: Plan outcome based business meetings, discussions and prepare the related official documents.

CO4: Emerge successful in professional project presentations, group discussions and result oriented agreeable solutions in group communication situations.

CO5: Apply critical and creative thinking to overcome workplace challenges by understanding professional and interpersonal relationships.


CO6: Apply codes of ethical conduct, professional etiquette and norms of behavior.

<b>Module No.</b>	<b>Detailed Content</b>	<b>Hrs (26)</b>	<b>CO</b>
<b>1</b>	<b>Advanced technical writing</b> Report writing: purpose and types of reports, parts of a long formal report, prefatory parts (front matter), report proper (main body), appended parts (back matter), language, formatting and referencing of a report, referencing styles in APA, MLA, & IEEE format. Business/technical proposal: Definition, purpose & types of proposals, solicited & unsolicited proposals, requests for proposals (RFP), types of proposal. Technical paper writing: parts of a technical paper, language and formatting, referencing in IEEE format	<b>6</b>	<b>CO1</b>
<b>2</b>	<b>Employment skills</b> Group discussions: Purpose of a GD, parameters of evaluating a GD, GD etiquettes, dos and don'ts of a GD. Cover letter & resume: Parts and content of a cover letter, difference between bio data, resume & CV, essential parts of a resume, types of resume (chronological, functional & combination). Personal interviews: Areas of preparation prior to interview, list of commonly asked questions, types of interviews (structured, stress, behavioral, problem solving & case study based), modes of interviews (face-to-face, through digital platforms)	<b>4</b>	<b>CO2</b>
<b>3</b>	<b>Managing business meetings and documentation</b> Types of meetings (informative, consultative, & executive), problem solving procedures, decision making methods (by authority, majority voting, consensus, unanimity), planning & scheduling meetings, roles & responsibilities of chairman, secretary and members, meeting etiquette, meeting documentation, notice, agenda, minutes	<b>4</b>	<b>CO3</b>
<b>4</b>	<b>Technical / business presentation skills</b> Effective presentation strategies: Defining purpose, analysing audience, location and event, gathering, selecting & structuring material, structuring a presentation, types of presentations aids, using the body & voice for maximum impact, effective opening and closing strategies	<b>4</b>	<b>CO4</b>
<b>5</b>	<b>Interpersonal skills</b> Interpersonal skills & organisational behaviour: Emotional intelligence, leadership, negotiation & conflict management, time management, team building, motivation, assertiveness	<b>4</b>	<b>CO5</b>
<b>6</b>	<b>Business etiquette</b> Social Etiquette: Shaking hands, exchanging business cards, introducing self/colleague/classmate; Cubical etiquette, dining etiquette, etiquette for meetings through digital platform, responsible use of social media	<b>4</b>	<b>CO6</b>

**Text books:**

1. Asha Kaul: Effective Business Communication: PHI Learning
2. Sanjay Kumar PushpLata: Communication Skills: Second Edition:Oxford Publication
3. Rizvi Ashraf: Effective Technical Communication: Tata Mc Graw-Hill
4. Jeff Butterfield: Soft Skills for Everyone: Cengage Learning
5. Chaturvedi and Chaturvedi: Business Communication: Pearson Education
6. Masters Wallace: Personal Development for Life and Work: Cengage Learning
7. Manuel G.Velasquez : Business Ethics-Concepts & Cases: Pearson Education



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<b>Course Code</b>	<b>Course Name</b>	<b>Teaching Scheme (Contact Hours 26)</b>				<b>Credits Assigned</b>			
		Theory		Practical		Theory		Total	
2413CAV3T1	Environmental Science	02		--		02		<b>02</b>	
		<b>Theory Evaluation Scheme (Marks)</b>							
		Internal Assessment (30)					End Sem. Exam	End Sem. Exam Hrs.	Total
		Best 1 (10)		(20)					
		CA1	CA2	Assignment / Tutorial	Quiz / Seminar	Open Book Test / Surprise Test /Capstone Project			
		10	10	10	05	05	<b>60</b>	02	<b>90</b>

• **Course Description:**

This course illustrates environmental challenges, ecosystems, sustainable development, pollution control, renewable energy, and disaster management. Students will explore real-world case studies and understand how to address climate change and manage resources effectively.

• **Course Objectives:**

- To develop an integrated approach to environmental issues with a focus on sustainability
- To enable learners to recognize the physical, chemical, and biological components of the earth's systems and relate their interdependence
- To understand the temporal dimension of the environment, including what forces have created the contemporary environment and what effects current behavior may have on future environments


• **Course Outcomes:** After completion of this course, learners will be able to:

- CO1: Implement scientific, technological, economic and political solutions to environmental problems
- CO2: Apply the idea for creating alternate possibilities to deal with environmental threat issues due to pollution
- CO3: Identify and develop different kinds of eco-friendly measures on personal and social level
- CO4: Develop sustainable interaction methods among humans and in between humans and natural world
- CO5: Interpret and apply basic environmental regulations and ethics to assess socio-environmental conditions.
- CO6: To reduce pollution and degradation of the environment and efficiently using energy, water and other resources.

<b>Module No.</b>	<b>Detailed Content</b>	<b>Hrs (26)</b>	<b>CO</b>
<b>1</b>	<b>Energy and Ecosystem</b> Public awareness of environmental education, Global crisis related to – Population, water, sanitation & Land. Study of ecosystems: Forest, desert and aquatic, Energy flow in Ecosystem: overview of Food Chain, Food Web and Ecological Pyramid. Concept of ecological succession and its impact on human beings	<b>3</b>	<b>CO1</b>
<b>2</b>	<b>Sustainable Development and Climate change</b> Concept and Definition of Sustainable Development. Social, Economical and Environmental aspects of sustainable development. Control measures: 3R (Reuse, Recovery, Recycle), Resource utilization as per the carrying capacity (in brief).	<b>3</b>	<b>CO2</b>
<b>3</b>	<b>Pollution and Control</b> Sources, effects and control of water, soil, land, air, noise and e-pollution. Greenhouse effect, Photochemical Smog, Nuclear pollution: Sources and effects. Case study on London smog, Case Study of Fukushima Disaster.	<b>6</b>	<b>CO3</b>
<b>4</b>	<b>Pollution Control Legislation</b> Functions and powers of Central and State Pollution Control Board. Environmental Clearance, Consent and Authorization Mechanism. Case Study of Dombivali MIDC- Boiler Blast Tragedy (Thane, Maharashtra, India), (May, 2016).	<b>4</b>	<b>CO4</b>
<b>5</b>	<b>Renewable Sources of Energy</b> Importance of renewable sources of energy. Solar Energy, Wind Energy, Hydropower, Geothermal Energy	<b>5</b>	<b>CO5</b>
<b>6</b>	<b>Disaster Management</b> Carbon Credit: Introduction and general concept. Techniques of Disaster Management to cope up with (i) Earthquake and (ii) Flood. Case Study on Earthquake in Latur (Maharashtra, India), Case Study on Cloudburst and Landslides at Kedarnath (Uttarakhand, India)	<b>5</b>	<b>CO6</b>

#### **Text books:**

1. Environmental Studies by Benny Joseph, TataMcGraw Hill.
2. Environmental Studies by R.Rajagopalan, Oxford University Press.
3. Environmental Studies by. AnanditaBasak, Pearson Education.
4. Essentials of Environmental Studies by Kurian Joseph & Nagendran, Pearson Education.
5. Fundamentals of Environmental Studies by Varadbal G. Mhatre, Himalaya Publication House.
6. Perspective of Environmental Studies, by Kaushik and Kaushik, New Age International.
7. Renewable Energy by Godfrey Boyle, Oxford Publications.
8. Textbook of Environmental Studies by Dave and Katewa, Cengage Learning.
9. Textbook of Environmental studies by ErachBharucha, University Press.
10. Environmental pollution control engineering by C.S. Rao, New Age

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Course Code	Course Name	Teaching Scheme (Contact Hours 26)			Credits Assigned		
		Theory		Practical	Practical	Total	
2413CAS3L1	Skill Based Lab – I: OOP with Java	--		04	02	<b>02</b>	
		Practical Evaluation Scheme (Marks)					
		Internal Assessment (30)			End Semester Examination (30)		Total
		Continuous Evaluation	Lab Quiz	Attendance	Practical Performance	Oral	
		20	05	05	20	10	

• **Course Objectives:**

- Understand the foundational object-oriented programming principles using Java.
- Explore the fundamental concepts of classes and objects, including their creation, instantiation, and complex interactions in Java programming.
- Develop advanced Java programming skills in multithreading, exception handling, and package management.
- Implement GUI programming techniques with Java Swing and JavaScript for creating interactive applications.

• **Course Outcomes:** After completion of this course, learners will be able to:

- CO1: Understand basics of OOP and apply fundamental programming construct.
- CO2: Apply the fundamental concepts of classes and objects in Java programming.
- CO3: Elaborate the concept of strings, arrays and vectors.
- CO4: Build and understand the concept of inheritance, interfaces and packages.
- CO5: Implement the skills of multithreading, exception handling, and package management.
- CO6: Design and Implement GUI based user defined applications using Java swing and Java script.

<b>Module No.</b>	<b>Detailed Content</b>	<b>Hrs (26)</b>	<b>CO</b>
<b>1</b>	<b>Introduction to Object-Oriented Programming:</b> Basic Concepts of Object-Oriented Programming, Introduction to OOP languages: C++ and Java. Basic Constructs of Java Programming.	3	<b>CO1</b>
<b>2</b>	<b>Class and Objects:</b> Introduction to Class and Object Fundamentals Method Definition, Access Specifier, Method Overloading and Constructor Overloading.	5	<b>CO2</b>
<b>3</b>	<b>Arrays and String function:</b> Arrays and String class Defining Arrays, String and String Buffer, Abstract Class and Method Overriding.	4	<b>CO3</b>
<b>4</b>	<b>Class Inheritance and Packages:</b> Importance of Inheritance, Different Types of Inheritance, Super keyword, Method Overriding. Packages: Built in and User Defined Packages in Java.	5	<b>CO4</b>
<b>5</b>	<b>Exception Handling and Multithreading:</b> Exception Handling and Multithreading, Error vs Exception, Concept of Exception Handling, Life Cycle of multithreading, Creating Threads.	4	<b>CO5</b>
<b>6</b>	<b>GUI based Java scripting:</b> GUI Programming Introduction to Java Swing class, Container Class, Difference Between AWT And Swing, Design Dynamic Page and build various features using Java script.	5	<b>CO6</b>


#### **List of Experiments:**

<b>Sr. No.</b>	<b>Title of the Experiment</b>	<b>CO</b>
1	Demonstrate control structures: if-else, switch, for and while loop and Construct Class and Object using Java Programming.	CO1 CO2
2	To Implement method overloading and Constructors overloading using java.	CO2
3	Build a Program on 1D and 2D array using java Programming.	CO3
4	Implementation of String Manipulation function and write a program to check whether the given string is palindrome or not.	CO3
5	To Implement a single and multilevel inheritance (Use super keyword).	CO4

6	To build an interface demonstrating concept of multiple inheritance.	CO4
7	Write a program to demonstrate exception handling: try, catch, throw, throws and finally	CO5
8	Design and implement user defined Exception handling using java.	CO5
9	Construct the component and container class to design GUI.	CO6
10	Build a dynamic feature using Java-based script.	CO6
11	Capstone Project.	

### References:

1. Schildt, Herbert. *"Java: The Complete Reference". IX<sup>th</sup> edition*, Oracle Press, 2014.
2. Malhotra, Sachin, and Saurabh Chaudhary. *"Programming in Java". II<sup>nd</sup> edition*, Oxford University Press, 2010.
3. Horton, Ivor. *"Beginning Java". II edition*, Wiley India, 2010.
4. Sharma, Rajesh. *"Learn to Master Java Programming". II<sup>nd</sup> edition.*, Staredu Solutions, 2024.
5. Web resources:  
<https://www.edx.org/learn/java>  
<https://www.coursera.org/courses?query=object%20oriented%20programming>  
<https://java-iitd.vlabs.ac.in/>

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Course Code	Course Name	Teaching Scheme (Contact Hours 26)				Credits Assigned		
		Theory		Practical		Practical	Total	
2413CAC3L1	Design and Analysis of Algorithms Lab	--		02		01	<b>01</b>	
		Practical Evaluation Scheme (Marks)						
		Internal Assessment (30)			End Semester Examination (30)		Total	
		Continuous Evaluation	Lab Quiz	Attendance	Practical Performance	Oral		
		20	05	05	20	10		
						<b>60</b>		

• **Course Objectives:**

- To introduce the methods of designing and analyzing algorithms
- Design and implement efficient algorithms for a specified application
- Strengthen the ability to identify and apply the suitable algorithm for the given real-world problem.
- Analyze worst-case running time of algorithms and understand fundamental algorithmic problems.

• **Course Outcomes:** After completion of this course, learners will be able to:


- CO1: Analyze the running time and space complexity of algorithms using different methods.
- CO2: Apply and analyze the complexity of algorithms based on divide and conquer approach.
- CO3: Implement and analyze the complexity of algorithms based on greedy strategy.
- CO4: Investigate the complexity of algorithms by applying dynamic programming strategy.
- CO5: Examine the complexity of algorithms by using the backtracking approach.
- CO6: Explore the complexity of algorithms by applying string-matching techniques.

**List of Experiments:**

Sr. No.	Title of the Experiment	CO
1	Implement Selection sort algorithm.	CO1
2	Analyze Binary Search technique using Divide and Conquer approach.	CO2
3	Implement Merge Sort algorithm using Divide and Conquer approach.	CO2
4	Solve Knapsack Problem using greedy approach.	CO3
5	Construct Single Source Shortest Path Algorithm (Dijkstra).	CO3
6	Construct Single Source Shortest Path Algorithm (Bellman-Ford).	CO4
7	Execute All Pair Shortest Path Algorithm (Floyd Warshall).	CO4
8	Find Longest Common Subsequence using dynamic programming approach.	CO4
9	Solve 8 Queen's Problem using backtracking approach.	CO5
10	Execute Naïve string-matching algorithm.	CO6
11	Capstone Project.	

**References:**

1. Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C., *Introduction to algorithms*, IV<sup>th</sup> Edition, MIT press, Cambridge 2022.
2. Ellis Horowitz, Sartaj Sahni, S. Rajsekar. *Fundamentals of computer algorithms*, II<sup>nd</sup> Edition, University science Press, New York, 2008.
3. <https://ds1-iiith.vlabs.ac.in/exp/quick-sort/index.html>.
4. <https://www.coursera.org/learn/cpsc-8400-design-and-analysis-of-algorithms>.
5. <https://www.edx.org/learn/algorithms/stanford-university-algorithms-design-and-analysis-part-2>.

 <div><b>D Y PATIL</b> DEEMED TO BE UNIVERSITY —RAMRAO ADIK— INSTITUTE OF TECHNOLOGY NAVI MUMBAI</div>		<b>B.TECH IN COMPUTER SCIENCE &amp; ENGINEERING (ARTIFICIAL INTELLIGENCE &amp; MACHINE LEARNING)</b>				<b>SECOND YEAR SEM- III</b>	
<b>Course Code</b>	<b>Course Name</b>	<b>Teaching Scheme (Contact Hours 26)</b>				<b>Credits Assigned</b>	
		Theory		Practical		Practical	Total
2413CAC3L2	Database Management System Lab	--		02		01	<b>01</b>
		<b>Practical Evaluation Scheme (Marks)</b>					
		Internal Assessment (30)			End Semester Examination (30)		Total
		Continuous Evaluation	Lab Quiz	Attendance	Practical Performance	Oral	
		20	05	05	20	10	

- **Course Objectives:**
  - To explore design and develop of relational model
  - To present SQL and procedural interfaces to SQL comprehensively
  - To understand database integrity, and normalization for efficient data management.
  - To introduce the concepts of transactions and transaction processing
- **Course Outcomes:** After completion of this course, learners will be able to:
  - CO1: To present SQL and procedural interfaces to SQL comprehensively
  - CO2: Design ER /EER diagram and convert to relational model for the real-world application.
  - CO3: Understand and apply relational algebra, SQL Statements (DDL, DML, DCL) and constraints on the relations.
  - CO4: Write simple and complex queries.
  - CO5: Use PL / SQL Constructs and Trigger.
  - CO6: Demonstrate the concept of concurrent transactions execution and frontend-backend connectivity.



**List of Experiments:**

Sr. No.	Title of the Experiment	CO
1	Identify a database-oriented case study and formulate a detailed problem statement.	CO1
2	Design an Entity-Relationship (ER) / Extended Entity-Relationship (EER) Model.	CO2
3	Perform mapping of ER/EER to Relational schema model.	CO2
4	Create and populate database using Data Definition Language (DDL) and DML Commands for the specified System.	CO3
5	Apply Integrity Constraints for the specified system.	CO3
6	Perform Simple queries, string manipulation operations.	CO4
7	Implement and execute Nested queries and Complex queries.	CO4
8	Perform Join operations.	CO4
9	Implement Views, Triggers and Stored Procedures.	CO5
10	Study and understand Transaction and Concurrency control.	CO6
11	Capstone Project.	

**References:**

1. A. Silberschatz, H. F. Korth, and S. Sudarshan, *Database System Concepts*, VII ed. New York, USA: McGraw-Hill, 2019.
2. R. Elmasri, Fundamentals of *Database Systems*, VII ed. New Delhi, India: Pearson Education, 2017.
3. R. D. Chang, C. Iyer, S. Kotsovolos, N. Le, W. Li, B. Llewellyn, C. Racicot, M. Vemulapati, G. Viswanathan, and M. Yang, *PL/SQL User's Guide and Reference*, 10g, Redwood Shores, USA: Oracle, 2003.
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