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|--------------------------------|-------------------------------------------------------------------|------------------|
| <b>5<sup>th</sup> Semester</b> | <b>Integrated Professional Course (IPC)<br/>COMPUTER NETWORKS</b> | <b>M25BCS501</b> |
|--------------------------------|-------------------------------------------------------------------|------------------|

**1. Prerequisites**

| Sl. No. | Proficiency               | Pre-requisites                                                                                                                                                                               |
|---------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | General Computer Skills   | Familiarity with common operating systems like Windows and Linux is beneficial.                                                                                                              |
| 2       | Basic networking concepts | Familiarity with common network topologies like LANs, WANs, and their characteristics is helpful. Knowledge of common networking terms like IP address, email, websites, router, and switch. |
| 3       | Data Communication        | Understanding how data transmission takes place in the Physical and Datalink layer of the TCP/IP model is beneficial.                                                                        |
| 4       | Programming Skills        | A general understanding of programming languages can be beneficial in understanding network configurations and how network protocols are implemented.                                        |

**2. Syllabus**

| <b>COMPUTER NETWORKS<br/>SEMESTER – V</b>                                                                                                                                                                                                                                                                                |                                   |             |                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------|-----------------|
| Course Code                                                                                                                                                                                                                                                                                                              | <b>M25BCS501</b>                  | CIE Marks   | <b>50</b>       |
| Total Number of Teaching-Learning Hours/sem (L: T: P:TW: SL)                                                                                                                                                                                                                                                             | <b>48:0:32: 30:00 = 110 Hours</b> | SEE Marks   | <b>50</b>       |
|                                                                                                                                                                                                                                                                                                                          |                                   | Total Marks | <b>100</b>      |
| Credits                                                                                                                                                                                                                                                                                                                  | <b>04</b>                         | Exam Hours  | <b>03</b>       |
| <b>Course Objectives:</b>                                                                                                                                                                                                                                                                                                |                                   |             |                 |
| <ol style="list-style-type: none"> <li>Demonstration of application layer protocols</li> <li>Discuss transport layer services and understand UDP and TCP protocols</li> <li>Explain routers, IP, and Routing Algorithms in the network layer.</li> <li>Discuss the concepts of VoIP and multimedia networking</li> </ol> |                                   |             |                 |
| <b>Module - 1</b>                                                                                                                                                                                                                                                                                                        |                                   |             |                 |
| <b>Introduction to Network Layer:</b> Network layer Services, Packet Switching, Network Layer Performance, IPv4 Addresses, Forwarding of IP Packets, Internet Protocol, Mobile IP                                                                                                                                        |                                   |             |                 |
| <b>Textbook 1:</b> 18.1-18.5, 19.1,19.3                                                                                                                                                                                                                                                                                  |                                   |             | <b>10 Hours</b> |
| <b>Module – 2</b>                                                                                                                                                                                                                                                                                                        |                                   |             |                 |
| <b>Routing algorithms in Network layer:</b> Unicast Routing: Routing algorithms, unicast routing Protocols, Multicasting, Multicast Protocols, Next generation IP: IPv6 addressing, IPv6 Protocol, Transition from IPv4 to IP                                                                                            |                                   |             |                 |
| <b>Textbook 1:</b> 20.1-20.3, 21.2,21.3,22.1,22.2,22.4                                                                                                                                                                                                                                                                   |                                   |             | <b>10 Hours</b> |
| <b>Module – 3</b>                                                                                                                                                                                                                                                                                                        |                                   |             |                 |
| <b>Transport Layer:</b> Introduction, transport layer protocols, UDP, TCP (up to state transition diagram)                                                                                                                                                                                                               |                                   |             |                 |
| <b>Textbook 1:</b> 23.1,23.2,24.1-24.3(till 24.3.5)                                                                                                                                                                                                                                                                      |                                   |             | <b>10 Hours</b> |
| <b>Module – 4</b>                                                                                                                                                                                                                                                                                                        |                                   |             |                 |
| <b>TCP:</b> Windows in TCP, Flow control, Error control, TCP congestion control, TCP timers. Application layer: Introduction, Client-Server Programming, WWW, HTTP, FTP. E-mail                                                                                                                                          |                                   |             |                 |
| <b>Textbook 1:</b> 24.3.6 – 24.3.10, 25.1,25.2, 26.1-26.3                                                                                                                                                                                                                                                                |                                   |             | <b>10 Hours</b> |
| <b>Module – 5</b>                                                                                                                                                                                                                                                                                                        |                                   |             |                 |
| <b>Application layer Protocols:</b> Telnet, SSH, DNS. VoIP and Multimedia Networking: Overview of IP Telephony, VoIP Signalling Protocols, Real-Time Media Transport Protocols.                                                                                                                                          |                                   |             |                 |
| <b>Textbook 1:</b> 26.4 – 26.6, <b>Textbook 2:</b> 18.1-18.3                                                                                                                                                                                                                                                             |                                   |             | <b>10 Hours</b> |

| PRACTICAL COMPONENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Physical Demonstration of network components (router, modem, hub, switch, gateways, etc.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 2. Demonstration of the installation of Wireshark packet sniffer or any other suitable packet analyzer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 3. Assume that you are a network administrator for a medium-sized company. Recently, employees have reported slow internet speeds during working hours. Management suspects that unauthorized streaming or file-sharing may be affecting bandwidth.<br>Using Wireshark (or a suitable packet analyzer): <ul style="list-style-type: none"><li>Capture network traffic during peak hours.</li><li>Identify and classify different types of network traffic (e.g., HTTP, HTTPS, FTP, DNS, and streaming protocols).</li><li>Highlight any unusual or bandwidth-heavy traffic.</li></ul>                                                                                                                                                                                                                                                                                                                        |
| 4. Assume that you are a network support engineer in a software company. A client complains that the company's internal web application is slow to load, especially during login. The development team suspects it might be due to an inefficient TCP handshake or retransmissions in the backend communication. Use Wireshark to monitor and analyse TCP communication between the client machine and the web application server during login. <ul style="list-style-type: none"><li>Capture and examine the TCP handshake sequence. What are the SYN, SYN-ACK, and ACK flags used for?</li><li>Inspect the TCP headers. Describe the use of sequence number, acknowledgment number, window size, and flags in the captured packets.</li><li>Did you observe any retransmissions, delays, or abnormal terminations?</li><li>Based on your analysis, what might be causing the performance issues?</li></ul> |
| 5. Assume that you are a network technician in a corporate environment. A user reports being unable to access the company's intranet server. To verify the connectivity, you decide to use the ping command and analyze the ICMP messages using Wireshark.<br>Using Wireshark, capture ICMP traffic generated by pinging the intranet server. <ul style="list-style-type: none"><li>Identify and explain the ICMP frame format observed in the captured Echo Request and Echo Reply messages.</li><li>What is the significance of the Type, Code, Checksum, and Identifier fields in ICMP?</li><li>How do the interaction sequences of ICMP packets help in diagnosing network connectivity?</li><li>Were there any signs of packet loss, unreachable hosts, or TTL expiration?</li></ul>                                                                                                                    |
| 6. Assume that you are a network analyst at a company where employees complain that the internal company website takes too long to load. The web development team claims their backend is working fine, and the issue might be at the network or protocol level.<br>Use Wireshark to capture the HTTP traffic between a client and the internal web server while loading the page. <ul style="list-style-type: none"><li>Identify and describe the HTTP request and response format as seen in the capture (include method, URL, headers, status codes, etc.).</li><li>How do the TCP segments and HTTP messages interact? (Examine the TCP handshake and HTTP GET/POST sequence)</li><li>Based on the frame structure and interaction sequence, where might the delay be occurring—client, network, or server?</li></ul>                                                                                    |
| 7. Assume that you are a systems engineer working for a satellite communication company. The company is developing an onboard data transfer module for satellites, where the connection is intermittent and prone to high latency and data loss.<br>Implement a Sliding Window Protocol in the data link layer that ensures reliable and efficient transmission of data frames between two devices communicating over such a noisy channel. (using Java/Python)                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 8. Assume that you are a firmware engineer working on a microcontroller-based communication system for an automated medical device. The device frequently exchanges data with a central server over a serial communication interface (UART). Since even a single bit error can lead to incorrect readings or hazardous behaviour, data integrity is crucial.<br>Implement a CRC-CCITT (16-bit) error-detecting code for verifying data frames before processing them. (using Java/Python)                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 9. Assume that you are a software developer working on a local campus alert system for a university. The system must be lightweight, fast, and capable of sending broadcast messages (e.g., exam reminders, urgent alerts) from a central control room to clients (students) connected in the local network. To implement this (using Java/Python). <ul style="list-style-type: none"><li>Develop a server program that:</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Accepts text input from the administrator.</li><li>• Sends the message to the client using a UDP socket.</li><li>• Develop a client program that:<ul style="list-style-type: none"><li>• Waits for UDP messages from the server.</li><li>• Displays the incoming message on the screen</li></ul></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <p>10. Assume that you are working as a network engineer for a company that manages distributed applications across different departments. Due to security policies, users are not allowed to browse the entire file system on shared servers. Instead, they can request specific files by name, and if the file exists, it should be sent securely.</p> <p>To implement this, create a TCP-based client-server program that supports the following functionality:</p> <ul style="list-style-type: none"><li>• The client sends a file name to the server.</li><li>• The server checks if the file exists in a predefined directory.</li><li>• If present, the server sends the file contents over the TCP connection.</li><li>• If the file is not found, an error message is returned to the client.</li></ul> |
| <p><b>TEXTBOOKS:</b></p> <ol style="list-style-type: none"><li>1. Behrouz A. Forouzan, <b>Data Communications and Networking</b>, Fifth Edition, McGraw-Hill, Indian Edition</li><li>2. Nader F Mir, <b>Computer and Communication Networks</b>, 2nd Edition, Pearson, 2014.</li></ol> <p><b>REFERENCE BOOKS:</b></p> <ol style="list-style-type: none"><li>1. Larry L Peterson and Bruce S Davie, <b>Computer Networks</b>, fifth edition, ELSEVIER</li><li>2. Andrew S Tanenbaum, <b>Computer Networks</b>, fifth edition, Pearson</li></ol>                                                                                                                                                                                                                                                                   |

3. Teaching-Learning Process Strategies

| Sl. No | TLP Strategies          | Description                                                                                                                      |
|--------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 1      | Lecture Method          | Utilize various teaching methods within the lecture format to reinforce competencies.                                            |
| 2      | Video/Animation         | Use of diagrams, animations, and flowcharts to explain OSI and TCP/IP models, network topologies, and protocols.                 |
| 3      | Collaborative Learning  | Encourage collaborative learning for improved competency application.                                                            |
| 4      | Problem-Based Learning  | Encourage group discussion and collaborative problem-solving.                                                                    |
| 5      | Flipped Class Technique | Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies            |
| 6      | Laboratory Learning     | Utilize the facilities available in the laboratories to understand the behaviour of the materials by performing few experiments. |

4. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation:

CIE Split up for Integrated Professional Core Course (IPC)

|                | Components                      | Number     | Weightage | Max. Marks |
|----------------|---------------------------------|------------|-----------|------------|
| Theory (A)     | Internal Assessment - Tests     | 3          | 60%       | 15         |
|                | Term Work - TW                  | 2          | 40%       | 10         |
|                | Total Marks                     |            | 100%      | 25         |
| Laboratory (B) | Record Writing                  | Continuous | 60%       | 15         |
|                | Test at the end of the semester | 1          | 40%       | 10         |
|                | Total Marks                     |            | 100%      | 25         |

Final CIE Marks = (A) + (B)

A = Average of the best two Test marks

B = Average of the two Term Work marks

\* Assessment / Case Studies / Practices

1. Assignment, Quiz



2. Group Presentation
3. Mini-Project- group project.
4. Applications of Network (case study)

**Semester End Examination:**

1. The question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 questions from each module, each of the two questions under a module (with a maximum of 3 sub-questions), may have a mix of topics under that module if necessary.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

**5. Course Outcomes (COs) and Mapping with POs/ PSOs**

**Course Outcomes (COs)**

| COs         | Description                                                                                                |
|-------------|------------------------------------------------------------------------------------------------------------|
| M25BCS501.1 | Understand and apply the various routing algorithms and Internet protocols such as [IPV4, IPV6].           |
| M25BCS501.2 | Recognize transport layer services and infer UDP and TCP protocols                                         |
| M25BCS501.3 | Analyze the principles of application layer protocols                                                      |
| M25BCS501.4 | Implement various Routing protocols and their services using tools such as Cisco Packet Tracer/ Wireshark. |

**CO-PO-PSO Mapping**

| COs/POs     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO11 | PSO1 | PSO2 |
|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|------|------|------|
| M25BCS501.1 | 3   | -   | -   | -   | -   | -   | -   | -   | -   | -     | -    | -    | 3    |
| M25BCS501.2 | -   | 3   | -   | -   | -   | -   | -   | -   | -   | -     | -    | 3    | -    |
| M25BCS501.3 | -   | 3   | -   | -   | -   | -   | -   | -   | -   | -     | -    | 3    | -    |
| M25BCS501.4 | -   | -   | 3   | -   | 3   | -   | -   | -   | -   | -     | -    | -    | 3    |
| M25BCS501   | 3   | 3   | 3   | -   | 3   | -   | -   | -   | -   | -     | -    | 3    | 3    |

**6. Mapping to Sustainable Development Goals (SDG):**

| Sl. No. | SDG                                                   | Justification                                                                                                                                      |
|---------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | <b>SDG 4: Quality education</b>                       | Access to the internet and digital learning resources, facilitated by computer networks, is essential for quality education and lifelong learning. |
| 2       | <b>SDG 8: Decent work and economic growth</b>         | CTs, including computer networks, are vital for creating jobs, promoting entrepreneurship, and driving economic growth.                            |
| 3       | <b>SDG 9: Industry, Innovation and Infrastructure</b> | Computer networks are the foundation for digital infrastructure, enabling access to information, online services, and economic opportunities.      |
| 4       | <b>SDG 17: Partnership for the goals</b>              | International cooperation in building digital infrastructure and sharing technological advancements is crucial for achieving the SDGs.             |

|                          |                                                        |           |
|--------------------------|--------------------------------------------------------|-----------|
| 5 <sup>th</sup> Semester | Professional Core Course (PC)<br>THEORY OF COMPUTATION | M25BCS502 |
|--------------------------|--------------------------------------------------------|-----------|

1. Prerequisites

| Sl. No. | Proficiency                | Pre-requisites                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Mathematical Foundations   | Discrete Mathematics: Understanding topics such as sets, relations, functions, combinatorics, logic, and proof techniques (e.g., induction, contradiction) is crucial.<br>Graph Theory: Basic knowledge of graphs, trees, and their properties.<br>Linear Algebra: While not always essential, it can be helpful in certain areas like quantum computation.<br>Number Theory: Basics of primes, divisibility, and modular arithmetic can be useful. |
| 2       | Formal Logic               | Propositional Logic: Basic logical operations, truth tables, and logical equivalences.<br>Predicate Logic: Understanding of quantifiers, predicates, and logical inference.                                                                                                                                                                                                                                                                         |
| 3       | Programming and Algorithms | Data Structures: Familiarity with common data structures like arrays, lists, stacks, queues, trees, and graphs.<br>Algorithms: Basic knowledge of algorithm design, analysis (time and space complexity), and common algorithms (e.g., sorting, searching).<br>Programming: Proficiency in at least one programming language is helpful for implementing and understanding theoretical concepts.                                                    |
| 4       | Problem-Solving Skills     | Apply theoretical concepts to solve computational problems.                                                                                                                                                                                                                                                                                                                                                                                         |

2. Syllabus

| THEORY OF COMPUTATION<br>SEMESTER – V                                                                                                                                                                                                                                                                                                                                                                                                                                 |                         |             |                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------|----------------|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                           | M25BCS502               | CIE Marks   | 50             |
| Total Number of Teaching-Learning Hours /sem (L:T: P:TW:SL)                                                                                                                                                                                                                                                                                                                                                                                                           | 32:32:0:16:0 = 80 Hours | SEE Marks   | 50             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                         | Total Marks | 100            |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 03                      | Exam Hours  | 03             |
| <b>Course Objectives:</b> <ol style="list-style-type: none"><li>1. Introduce core concepts in Automata and Theory of Computation</li><li>2. Identify different Formal Language Classes and their Relationships</li><li>3. Design Grammars and Recognizers for different formal languages</li><li>4. Prove or disprove theorems in automata theory using their properties</li><li>5. Determine the decidability and intractability of Computational problems</li></ol> |                         |             |                |
| <b>Module -1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                         |             |                |
| Introduction to Finite Automata, Structural Representations, Automata and Complexity. The Central Concepts of Automata Theory. Deterministic Finite Automata, Nondeterministic Finite Automata, An Application: Text Search, Finite Automata with Epsilon-Transitions.<br><b>Textbook 1:Ch 1.1,1.5,2.2,2.3,2.4,2.5</b>                                                                                                                                                |                         |             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                         |             | <b>8 Hours</b> |
| <b>Module -2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                         |             |                |
| Regular Expressions, Finite Automata and Regular Expressions, Proving Languages not to be Regular. Closure Properties of Regular Languages, Equivalence and Minimization of Automata, Applications of Regular Expressions<br><b>Textbook 1:Ch 3.1, 3.2 (Except 3.2.1), 3.3, 4.1, 4.2, 4.4</b>                                                                                                                                                                         |                         |             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                         |             | <b>8 Hours</b> |
| <b>Module -3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                         |             |                |
| <b>Context-Free Language:</b> Context-Free Language and Derivation trees, Ambiguity in context-free grammars, simplifying of context-free grammars, Normal forms for CFGs<br><b>Textbook 2:Ch 6.1-6.4,7.1</b>                                                                                                                                                                                                                                                         |                         |             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                         |             | <b>8 Hours</b> |
| <b>Module -4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                         |             |                |



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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <b>Pushdown Automata (PDA):</b> Definition of the Pushdown Automaton, The Languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata.<br>Properties of Context-Free Languages: The pumping lemma for CFGs; Closure properties of CFLs<br><b>Textbook 1:Ch 6.1,6.2,6.3.1,6.4,7.2,7.3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>8 Hours</b> |
| <b>Module -5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                |
| <b>Turing Machine:</b> Turing machine model, Representation, Language acceptability by TM, design of TM, Techniques for TM construction. Variants of Turing Machines (TM), The model of Linear Bounded automata Decidability: Definition of decidability, decidable languages, Undecidable languages, halting problem of TM, Post correspondence problem.<br><b>Textbook 2:Ch 9.1-9.8,10.1-10.7</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>8 Hours</b> |
| <b>TEXTBOOKS:</b> <ol style="list-style-type: none"><li>1. John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman," Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson.</li><li>2. K L P Mishra, N Chandrasekaran , 3rd Edition, Theory of Computer Science, PHI, 2012.Marketing Management: A relationship approach (2019), Hollensen, S, Pearson Education.</li></ol> <b>REFERENCE BOOKS:</b> <ol style="list-style-type: none"><li>1. Elain Rich, "Automata, Computability and complexity", 1st Edition, Pearson Education, 2018.</li><li>2. Michael Sipser : Introduction to the Theory of Computation, 3rd edition, Cengage learning,2013</li><li>3. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw –Hill Publishing Company Limited, 2013</li><li>4. Basavaraj S. Anami, Karibasappa K G, Formal Languages and Automata theory, Wiley India, 2012</li></ol> <b>Faculty can utilize open source tools (like JFLAP) to make teaching and learning more interactive.</b> |                |

**3. Teaching-Learning Process Strategies**

| Sl. No. | TLP Strategies                  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Start with Real-World Examples  | Teaching Approach: Begin by introducing concepts using real-world analogies or simple, relatable examples. For instance, explain finite automata using examples like traffic light systems or vending machines.<br>Learning Approach: Encourage students to think of everyday processes or systems that can be modeled by the concepts being studied.                                                                                                                              |
| 2       | Problem-Based Learning (PBL)    | Teaching Approach: Present students with problems that require them to apply theoretical concepts to find solutions. This could involve designing automata for specific tasks, proving language properties, or reducing problems to show complexity classifications.<br>Learning Approach: Engage in active problem-solving during and outside class. Form study groups to tackle challenging problems collectively, enhancing understanding through discussion and collaboration. |
| 3       | Use of Visual Aids and Diagrams | Teaching Approach: Incorporate diagrams, flowcharts, and other visual aids to explain abstract concepts. For instance, use state diagrams to represent finite automata or Turing machines.<br>Learning Approach: Create your own visual representations of concepts as a study tool. Drawing out problems and solutions can help clarify complex ideas..                                                                                                                           |
| 4       | Collaborative Projects          | Teaching Approach: Assign group projects where students can work together to explore a theoretical concept in depth or implement a computational model.<br>Learning Approach: Collaborate effectively with peers, dividing tasks based on individual strengths while ensuring everyone understands the overall project.                                                                                                                                                            |
| 5       | Multimodal Teaching             | Teaching Approach: Incorporate a mix of lectures, visual aids, interactive simulations, group work, and hands-on projects to cater to different learning styles.<br>Learning Approach: Identify your preferred learning style and seek out resources or study methods that align with it, whether it's visual, auditory, reading/writing, or kinesthetic.                                                                                                                          |



4. **Assessment Details (both CIE and SEE)**

**Continuous Internal Evaluation:**

**CIE Split up for Professional Course (PC)**

| Components         |                               | Number | Weightage | Max. Marks |
|--------------------|-------------------------------|--------|-----------|------------|
| 1                  | Internal Assessment-Tests (A) | 3      | 50%       | 25         |
| 2                  | Team Work (B)                 | 2      | 50%       | 25         |
| <b>Total Marks</b> |                               |        |           | <b>50</b>  |

**Final CIE Marks = (A) + (B)**

**A** = Average of best two Test marks

**B** = Average of two Term Work marks

**Semester End Examination:**

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

5. **Course Outcomes (COs) and Mapping with POs/ PSOs**

**Course Outcomes (COs)**

| Cos                | Description                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>M25BCS502.1</b> | <b>Interpret</b> the fundamental concepts of theory and Computation.                                                         |
| <b>M25BCS502.2</b> | <b>Apply</b> analytical principles and theoretical foundations to identify and differentiate language classes.               |
| <b>M25BCS502.3</b> | <b>Analyze</b> models of computation like Deterministic, Non deterministic and abstract software models for a given problem. |
| <b>M25BCS502.4</b> | <b>Evaluate</b> problems using formal reasoning techniques, including reductions and decidability proofs.                    |

**CO-PO-PSO Mapping**

| COs/POs            | PO1      | PO2        | PO3        | PO4        | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1     | PSO2     |
|--------------------|----------|------------|------------|------------|-----|-----|-----|-----|-----|------|------|----------|----------|
| <b>M25BCS502.1</b> | 3        | 2          | -          | -          | -   | -   | -   | -   | -   | -    | -    | 3        | -        |
| <b>M25BCS502.2</b> | 3        | 3          | 2          | -          | -   | -   | -   | -   | -   | -    | -    | 3        | -        |
| <b>M25BCS502.3</b> | 3        | 3          | 3          | 2          | -   | -   | -   | -   | -   | -    | -    | -        | 3        |
| <b>M25BCS502.4</b> | 3        | 3          | 2          | 3          | -   | -   | -   | -   | -   | -    | -    | -        | 3        |
| <b>M25BCS502</b>   | <b>3</b> | <b>2.7</b> | <b>2.3</b> | <b>2.5</b> | -   | -   | -   | -   | -   | -    | -    | <b>3</b> | <b>3</b> |

6. **Mapping to Sustainable Development Goals (SDG):**

| Sl. No. | SDG                                    | Justification                                                                                                                     |
|---------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| 1       | SDG 4: Quality Education               | Enhances theoretical computing skills and mathematical rigor which are foundational in computer science education.                |
| 2       | SDG 8: Decent Work and Economic Growth | Prepares students with strong computation fundamentals to contribute to innovation and development in the digital economy.        |
| 3       | SDG 9: Industry, Innovation, and       | Equips students with knowledge for solving problems related to compiler design, language processing, and automation, all critical |

|                          |                                                   |           |
|--------------------------|---------------------------------------------------|-----------|
| 5 <sup>th</sup> Semester | Professional Core Course (PC)<br>SOFTWARE TESTING | M25BIS503 |
|--------------------------|---------------------------------------------------|-----------|

1. Prerequisites

| Sl. No. | Proficiency                           | Pre-requisites                                                                                                                                                                                                                                                                                                                                                                                |
|---------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Fundamentals of Software Testing      | Types of Testing: Understanding different types of testing (e.g., unit testing, integration testing, system testing, and acceptance testing).<br>Testing Techniques: Knowledge of both manual and automated testing techniques.<br>Test Cases: Ability to write and execute test cases, and understand test case design techniques (e.g., equivalence partitioning, boundary value analysis). |
| 2       | Software Development Lifecycle (SDLC) | Phases: Knowledge of various stages of SDLC (e.g., requirements analysis, design, implementation, testing, deployment, maintenance).<br>Models: Understanding different development methodologies (e.g., Agile, Waterfall).                                                                                                                                                                   |
| 3       | Software Quality Assurance (QA)       | QA Principles: Basic principles of quality assurance and its role in software development.<br>Metrics: Familiarity with metrics for evaluating software quality (e.g., defect density, test coverage).                                                                                                                                                                                        |
| 4       | Debugging Skills                      | Tools: Ability to use debugging tools and techniques to identify and fix issues in code.<br>Strategies: Understanding common debugging strategies and practices.                                                                                                                                                                                                                              |

2. Syllabus

| SOFTWARE TESTING<br>SEMESTER – V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                           |             |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------|-----|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | M25BIS503                 | CIE Marks   | 50  |
| Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 32:32:0:16:20 = 100 Hours | SEE Marks   | 50  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                           | Total Marks | 100 |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 03                        | Exam Hours  | 03  |
| <b>Course objectives:</b> This course will enable students to:<br>1. Differentiate the various testing techniques<br>2. Analyze the problem and derive suitable test cases.<br>3. Apply suitable technique for designing of flow graph<br>4. Explain the need for planning and monitoring a process                                                                                                                                                                                                                                                                                                                                                                                                |                           |             |     |
| <b>Module -1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                           |             |     |
| <b>Basics of Software Testing:</b> Basic definitions, Software Quality , Requirements, Behaviour and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies , Levels of testing, Testing and Verification, Static Testing. <b>Problem Statements:</b> Generalized pseudocode, the triangle problem, the Next Date function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper<br><b>T1:Chapter1, T1:Chapter2.</b> <b>8 Hours</b>                                     |                           |             |     |
| <b>Module -2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                           |             |     |
| <b>Functional Testing:</b> Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, Nextdate problem and commission problem, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations, Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. <b>Fault Based Testing:</b> Overview, Assumptions in fault based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis.<br><b>T1: Chapter 5, 6 &amp; 7, T2: Chapter 16</b> <b>8 Hours</b> |                           |             |     |
| <b>Module -3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                           |             |     |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------|
| <b>Structural Testing:</b> Overview, Statement testing, Programme testing, Condition testing, Path testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations, Data –Flow testing: Definition-Use testing, Slice-based testing, Guidelines and observations. <b>Test Execution:</b> Overview of test execution, from test case specification to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay<br><b>T1:Chapter 9 &amp; 10, T2:Chapter 17</b>                                                                                                                                                             |  | <b>8 Hours</b> |
| <b>Module - 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |                |
| <b>Process Framework:</b> Basic principles: Sensitivity, redundancy, restriction, partition, visibility, Feedback, the quality process, Planning and monitoring, Quality goals, Dependability properties ,Analysis Testing, Improving the process, Organizational factors. <b>Planning and Monitoring the Process:</b> Quality and process, Test and analysis strategies and plans, Risk planning, monitoring the process, Improving the process, the quality team <b>Documenting Analysis and Test:</b> Organizing documents, Test strategy document, Analysis and test plan, Test design specifications documents, Test and analysis reports.<br><b>T2: Chapter 3 &amp; 4, T2: Chapter 20, T2: Chapter 24.</b> |  | <b>8 Hours</b> |
| <b>Module - 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |                |
| <b>Integration and Component-Based Software Testing:</b> Overview, Integration testing strategies, Testing components and assemblies. System, Acceptance and Regression Testing: Overview, System testing, Acceptance testing, Usability, Regression testing, Regression test selection techniques, Test case prioritization and selective execution. Levels of Testing <b>Introduction to Selenium:</b> Selenium IDE installation – Recording and running test cases using Selenium IDE – Selenium Commands.<br><b>T2: Chapter 21 &amp; 22</b>                                                                                                                                                                  |  | <b>8 Hours</b> |
| <b>TEXT BOOKS:</b><br>1. Paul C. Jorgensen: Software Testing, A Craftsman’s Approach, 3rd Edition, Auerbach Publications, 2008. (Listed topics only from Chapters 1, 2, 5, 6, 7, 9, 10, 12, 13)<br>2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009. (Listed topics only from Chapters 3, 4, 16, 17, 20,21, 22,24)<br><b>REFERENCE BOOKS:</b><br>1. Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2nd Edition, Pearson, 2007<br>2. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004.<br>3. The Craft of Software Testing – Brian Marrick, Pearson Education, 1995.                   |  |                |

3. Teaching-Learning Process Strategies

| Sl. No. | TLP Strategies               | Description                                                                                 |
|---------|------------------------------|---------------------------------------------------------------------------------------------|
| 1       | Lecture Method               | Utilize various teaching methods within the lecture format to reinforce competencies.       |
| 2       | Video/Animation              | Incorporate visual aids like videos/animations to enhance understanding of concepts.        |
| 3       | Collaborative Learning       | Encourage collaborative learning for improved competency application                        |
| 4       | Problem-Based Learning (PBL) | Implement PBL to enhance analytical skills and practical application of competencies        |
| 5       | Multiple Representations     | Introduce topics in various representations to reinforce competencies                       |
| 6       | Real-World Application       | Discuss practical applications to connect theoretical concepts with real-world competencies |
| 7       | Programming Assignments      | Assign programming tasks to reinforce practical skills associated with competencies.        |

4. Assessment Details (both CIE and SEE)

**Continuous Internal Evaluation:**

The minimum CIE marks requirement is 40% of maximum marks in each component.

**CIE Split up**

| Components         |                               | Number | Weightage | Max. Marks |
|--------------------|-------------------------------|--------|-----------|------------|
| 1                  | Internal Assessment-Tests (A) | 3      | 50%       | 25         |
| 2                  | Team Work (B)                 | 2      | 50%       | 25         |
| <b>Total Marks</b> |                               |        |           | <b>50</b>  |

**Final CIE Marks = (A) + (B)**  
**A=** Average of best two Test marks  
**B=** Average of two Term work marks

**Self-Learning (SL): If applicable,** the teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The faculty must collect the certificate from the students who have successfully completed the self-learning relevant to the course.

**Semester End Examination:**

- Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
- There shall be 2 questions from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
- The students have to answer 5 full questions selecting one full question from each module.
- Marks scored will be proportionally scaled down to 50 marks

**5. Course Outcomes (COs) and Mapping with POs/ PSOs**

**Course Outcomes (COs)**

| COs                | Description                                                                              |
|--------------------|------------------------------------------------------------------------------------------|
| <b>M25BIS503.1</b> | Apply the significance of software testing and quality assurance in software development |
| <b>M25BIS503.2</b> | Apply the concepts of software testing to assess the most appropriate testing method.    |
| <b>M25BIS503.3</b> | Analyse the importance of testing in software development.                               |
| <b>M25BIS503.4</b> | Evaluate the suitable testing model to derive test cases for any given software.         |

**CO-PO-PSO Mapping**

| COs/POs            | PO1      | PO2        | PO3      | PO4      | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2     |
|--------------------|----------|------------|----------|----------|-----|-----|-----|-----|-----|------|------|------|----------|
| <b>M25BIS503.1</b> | <b>3</b> | -          | -        | -        | -   | -   | -   | -   | -   | -    | -    | -    | <b>3</b> |
| <b>M25BIS503.2</b> | -        | <b>3</b>   | -        | -        | -   | -   | -   | -   | -   | -    | -    | -    | <b>3</b> |
| <b>M25BIS503.3</b> | -        | <b>2</b>   | <b>3</b> | -        | -   | -   | -   | -   | -   | -    | -    | -    | -        |
| <b>M25BIS503.4</b> | -        | -          | -        | <b>3</b> | -   | -   | -   | -   | -   | -    | -    | -    | -        |
| <b>M25BIS503</b>   | <b>3</b> | <b>2.5</b> | <b>3</b> | <b>3</b> | -   | -   | -   | -   | -   | -    | -    | -    | <b>3</b> |

**6. Mapping to Sustainable Development Goals (SDG):**

| Sl. No. | SDG                                                    | Justification                                                                                                                                                                                          |
|---------|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | <b>SDG 3:</b> Good Health and Well-Being               | In health tech (e.g., medical devices, telemedicine apps), rigorous testing is essential to ensure systems are safe and error-free, minimizing health risks.                                           |
| 2       | <b>SDG 4 –</b> Quality Education                       | Software used in educational platforms (e-learning, EdTech apps, etc.) must be reliable. Testing ensures accessibility, performance, and accuracy, enhancing digital learning.                         |
| 3       | <b>SDG 9:</b> Industry, Innovation and Infrastructure, | High-quality software underpins modern infrastructure and innovation. Testing ensures reliability, security, and performance of systems that power smart cities, transportation, healthcare, and more. |



|                          |                                               |            |
|--------------------------|-----------------------------------------------|------------|
| 5 <sup>th</sup> Semester | Professional Elective (PE)<br>WEB INFORMATICS | M25BIS504A |
|--------------------------|-----------------------------------------------|------------|

1. Prerequisites

| S/L | Proficiency                       | Prerequisites                                                                                                                                        |
|-----|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Basic Programming Skills          | Languages: HTML, CSS, JavaScript, and optionally Python or PHP.<br>Ability to write and debug code.                                                  |
| 2   | Understanding of Web Technologies | HTTP, URLs, web servers, browsers, and how the internet works.<br>Client-side vs. server-side technologies.                                          |
| 3   | Databases & Data Handling         | Basic knowledge of databases (especially relational databases like MySQL).SQL basics.<br>Understanding how data is stored, retrieved, and processed. |
| 4   | Basic Data Analysis               | Familiarity with data formats (CSV, JSON, XML).<br>Ability to manipulate and interpret structured data.                                              |

2. Syllabus

| WEB INFORMATICS<br>SEMESTER – V                                                                                                                                                                                                                                                                                                                                                                                                                  |                           |             |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------|-----|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                      | M25BIS504A                | CIE Marks   | 50  |
| Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)                                                                                                                                                                                                                                                                                                                                                                                       | 32:32:0:16:20 = 100 Hours | SEE Marks   | 50  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                           | Total Marks | 100 |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                          | 03                        | Exam Hours  | 03  |
| <b>Course Objectives:</b> <ul style="list-style-type: none"><li>Understand the principles and techniques of web information search.</li><li>Learn analytics methods for extracting meaningful insights from web data.</li><li>Explore tools and technologies used in web information retrieval.</li><li>Develop skills in designing effective search algorithms.</li><li>Apply analytics to improve decision-making based on web data.</li></ul> |                           |             |     |
| <b>Module -1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |             |     |
| <b>INTRODUCTION TO WEB INFORMATION RETRIEVAL</b> Definition and Importance of Web Information Retrieval - Basic Concepts of Search Engines - Types of Web Search Engines - Challenges in Web Information Retrieval.<br><b>Textbook 1(chapter 1,1.1-1.5)</b> <b>8 hours</b>                                                                                                                                                                       |                           |             |     |
| <b>Module -2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |             |     |
| <b>SEARCH ALGORITHMS</b> Ranking Algorithms in Web Search - PageRank Algorithm and its Variants - Evaluation Metrics for Search Algorithms - Designing Effective Search Algorithms.<br><b>Textbook 1(chapter 15 15.1-15.6)</b> <b>8 hours</b>                                                                                                                                                                                                    |                           |             |     |
| <b>Module -3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |             |     |
| <b>INTRODUCTION TO WEB ANALYTICS</b> - Data Collection Methods in Web Analytics - Analysing User Behaviour on the Web - Using Analytics for Business Decision-Making.<br><b>Textbook 2(chapter 3)</b> <b>8 hours</b>                                                                                                                                                                                                                             |                           |             |     |
| <b>Module -4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |             |     |
| <b>COMPETITIVE INTELLIGENCE ANALYSIS:</b> CI Data Sources, Types, and Secrets , Website Traffic Analysis Search and Keyword Analysis, Audience Identification and Segmentation Analysis.<br><b>Textbook 2 (chapter 8)</b> <b>8 hours</b>                                                                                                                                                                                                         |                           |             |     |
| <b>Module -5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |             |     |
| <b>EMERGING TRENDS IN WEB INFORMATION SEARCH AND ANALYTICS:</b> Personalized Search and Recommender Systems - Mobile Search and Voice Search - Deep Learning in Web Information Retrieval - Case Studies and Future Directions..<br><b>Textbook 2(chapter 9)</b> <b>8 hours</b>                                                                                                                                                                  |                           |             |     |



**TEXTBOOKS:**

1. Stefan Büttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information Retrieval: Implementing and Evaluating Search Engines" · 2016
2. Avinash Kaushik, Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity 2009

**REFERENCE BOOKS:**

1. Christopher D. Manning (Author), Prabhakar Raghavan (Author), Hinrich Schütze (Author) Introduction to Information Retrieval Hardcover 7 July 2008
2. Bruce Croft (Author), Donald Metzler (Author), Trevor Strohman (Author) Search Engines: Information Retrieval in Practice: United States Edition Hardcover – 6 February 2009

**3. Teaching-Learning Process Strategies**

| S/L | TLP Strategies:                    | Description                                                                                                                                                                                                                                         |
|-----|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Lecture Method                     | Interactive lectures using presentations and live demonstrations, Explanation of core web technologies, architecture, and protocol, Use of multimedia tools to visualize client-server communication, web design, and scripting.                    |
| 2   | Video/Animation                    | Lab sessions to practice HTML, CSS, JavaScript, PHP, MySQL, and APIs, Mini projects on building responsive web pages and interactive web applications, Use of tools like Visual Studio Code, XAMPP, and GitHub for development and version control. |
| 3   | Project-Based Learning             | Group and individual projects to build real-world web applications, Encouragement to solve real-life problems using web technologies, Integration of IoT data, web analytics, or machine learning models in projects.                               |
| 4   | Blended Learning Approach          | Supplement classroom teaching with online tutorials (NPTEL, freeCodeCamp, W3Schools), Assignments based on e-learning materials and coding challenge., Use of learning management systems (e.g., Google Classroom, Moodle) for resource sharing.    |
| 5   | Continuous Assessment and Feedback | Periodic quizzes, assignments, and coding tasks, Peer evaluations and instructor feedback on lab and project work, encouraging reflective learning through weekly progress logs or journals.                                                        |
| 6   | Industry Exposure and Trends       | Guest lectures from industry professionals, Awareness of modern web technologies like cloud integration, REST APIs, PWA, and cybersecurity basics, Exposure to real-time tools like Firebase, AWS, and Git for deployment.                          |
| 7   | Guest Lectures/Workshops           | Invite industry experts to deliver guest lectures or conduct workshops on emerging Web technologies and trends. This provides students with insights into current industry practices and innovations.                                               |

**4. Assessment Details (both CIE and SEE)**

**Continuous Internal Evaluation:**

**CIE Split up for Professional Elective (PE)**

| Components  |                               | Number | Weightage | Max. Marks |
|-------------|-------------------------------|--------|-----------|------------|
| 1           | Internal Assessment-Tests (A) | 3      | 50%       | 25         |
| 2           | Team Work (B)                 | 2      | 50%       | 25         |
| Total Marks |                               |        |           | 50         |

**Final CIE Marks = (A) + (B)**

**A**=Average of best two Test Marks

**B**=Average of two Term Work Marks

**Self-Learning (SL):** The teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The faculty must

2025 Scheme – 3<sup>rd</sup> to 8<sup>th</sup> Sem Competency Based Syllabus for B.E Information Science & Engineering

collect the certificate from the students who have successfully completed the self-learning relevant to the course.

Semester End Examination:

- 1) Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
- 2) There shall be 2 questions from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
- 3) The students have to answer 5 full questions selecting one full question from each module.
- 4) Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs  
Course Outcomes (COs)

| CO's         | Description                                                               |
|--------------|---------------------------------------------------------------------------|
| M25BIS504A.1 | Apply the principles and techniques of web information search.            |
| M25BIS504A.2 | Apply analytics methods for extracting meaningful insights from web data. |
| M25BIS504A.3 | Examine tools and technologies used in web information retrieval.         |
| M25BIS504A.4 | Develop skills in designing effective search algorithms.                  |
| M25BIS504A.5 | Analyse analytics to improve decision-making based on web data.           |

CO-PO-PSO Mapping

| COs/POs      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| M25BIS504A.1 | 3   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 3    |
| M25BIS504A.2 | 3   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | 3    | -    |
| M25BIS504A.3 | -   | 3   | 3   | -   | -   | -   | -   | -   | -   | -    | -    | 3    | -    |
| M25BIS504A.4 | -   | 3   | 3   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 3    |
| M25BIS504A.5 | -   | 3   | -   | -   | -   | -   | -   | -   | -   | -    | -    | 3    | -    |
| M25BIS504A   | 3   | 3   | 3   | -   | -   | -   | -   | -   | -   | -    | -    | 3    | 3    |

6. Mapping to Sustainable Development Goals (SDG):

| Sl. No. | SDG                                             | Justification                                                                                                                                  |
|---------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | SDG 4: Quality Education                        | Empowers students with modern digital and web development skills that are essential in today's technology-driven world.                        |
| 2       | SDG 8: Decent Work and Economic Growth          | Prepares learners for employment in IT and web development sectors by providing practical and industry-relevant skills.                        |
| 3       | SDG 9: Industry, Innovation, and Infrastructure | Encourages innovation by teaching students to design scalable, efficient, and secure web applications that can support digital infrastructure. |
| 4       | SDG 11: Sustainable Cities and Communities      | Supports smart city applications through integration with IoT and web-based systems for sustainable urban development.                         |
| 5       | SDG 17: Partnerships for the Goals              | Promotes collaboration through open-source contributions, cloud platforms, and integration with global APIs and data sharing systems.          |



|                                |                                                                  |                   |
|--------------------------------|------------------------------------------------------------------|-------------------|
| <b>5<sup>th</sup> Semester</b> | <b>Professional Elective (PE)<br/>CLOUD &amp; EDGE COMPUTING</b> | <b>M25BCS504B</b> |
|--------------------------------|------------------------------------------------------------------|-------------------|

**1. Prerequisites**

| Sl. No. | Proficiency                    | Pre-requisites                                                                                                                   |
|---------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 1       | Programming Fundamentals       | Knowledge of data structures and control structures is essential.                                                                |
| 2       | Operating Systems              | Knowledge of process management, memory management, file systems, and system calls.                                              |
| 3       | Fundamentals of Probability    | Knowledge of probability theory, including conditional probability, Bayes' theorem, and probability distributions, is essential. |
| 4       | Computer Networks and Security | Understanding of Computer Networks, Network Security network protocols, TCP/IP, DNS.                                             |

**2. Syllabus**

| <b>CLOUD &amp; EDGE COMPUTING<br/>SEMESTER – V</b>                                                                                                                                                                                                                                                                                      |                                  |             |                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------|----------------|
| Course Code                                                                                                                                                                                                                                                                                                                             | <b>M25BCS504B</b>                | CIE Marks   | <b>50</b>      |
| Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)                                                                                                                                                                                                                                                                              | <b>32:32:0:16:20 = 100 Hours</b> | SEE Marks   | <b>50</b>      |
|                                                                                                                                                                                                                                                                                                                                         |                                  | Total Marks | <b>100</b>     |
| Credits                                                                                                                                                                                                                                                                                                                                 | <b>03</b>                        | Exam Hours  | <b>03</b>      |
| <b>Course Objectives:</b>                                                                                                                                                                                                                                                                                                               |                                  |             |                |
| 1. To understand the core concept of cloud computing.<br>2. To understand the various models of cloud computing.<br>3. To analyze how to design cloud native applications.<br>4. To examine the importance of Cloud Virtualization Technologies.                                                                                        |                                  |             |                |
| <b>Module -1</b>                                                                                                                                                                                                                                                                                                                        |                                  |             |                |
| <b>Introduction</b> ,Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments, Amazon Web Services (AWS), Google App Engine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka.<br><b>Textbook 1: Chapter 1: 1.1,1.2 and 1.3</b>                                               |                                  |             | <b>8 hours</b> |
| <b>Module -2</b>                                                                                                                                                                                                                                                                                                                        |                                  |             |                |
| <b>Virtualization:</b> Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples.<br><b>Textbook 1 : Chapter 3: 3.1 to 3.6</b>                |                                  |             | <b>8 hours</b> |
| <b>Module -3</b>                                                                                                                                                                                                                                                                                                                        |                                  |             |                |
| <b>Cloud Computing Architecture:</b> Introduction, Cloud Reference Model, Types of Clouds, Economics of the Cloud, Open Challenges.<br><b>Textbook 1: Chapter 4: 4.1 to 4.5</b>                                                                                                                                                         |                                  |             | <b>8 hours</b> |
| <b>Module -4</b>                                                                                                                                                                                                                                                                                                                        |                                  |             |                |
| <b>Cloud Platforms in Industry</b> Amazon web services: - Compute services, Storage services, Communication services, Additional services. Google App Engine: - Architecture and core concepts, Application life cycle, Cost model, Observations.<br><b>Textbook 1: Chapter 9: 9.1 to 9.2</b>                                           |                                  |             | <b>8 hours</b> |
| <b>Module -5</b>                                                                                                                                                                                                                                                                                                                        |                                  |             |                |
| <b>Cloud Applications:-</b> Scientific applications, HealthCare: ECG analysis in the cloud, Biology: gene expression data analysis for cancer diagnosis, Geoscience: satellite image processing. Business and consumer applications: CRM and ERP, Social networking, media applications.<br><b>Textbook 1: Chapter 10: 10.1 to 10.2</b> |                                  |             | <b>8 hours</b> |
| <b>TEXT BOOKS:</b>                                                                                                                                                                                                                                                                                                                      |                                  |             |                |
| 1. Rajkumar Buyya, Christian Vecchiola, and Thamrai Selvi Mastering Cloud Computing McGraw Hill Education.                                                                                                                                                                                                                              |                                  |             |                |

**REFERENCE BOOKS:**

1. Borko Furht, Armando Escalante, “Handbook of Cloud Computing”, Springer.
2. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly Publication.

**3. Teaching-Learning Process Strategies**

| Sl. No. | TLP Strategies                           | Description                                                                                                                                                                                                                                                                                             |
|---------|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Lectures and Interactive Discussions     | Provide clear, concise explanations of key concepts, theories, and algorithms in each module. Use visual aids, such as slides and diagrams, to enhance understanding.                                                                                                                                   |
| 2       | Case Studies and Real-World Applications | Incorporate visual aids like videos/animations to enhance understanding the concepts. Incorporate case studies like the Real Direct example in Week 4 to demonstrate the application of data science concepts in real-world scenarios. This helps students see the relevance of what they are learning. |
| 3       | Collaborative Learning                   | Encourage collaborative learning for improved competency application.                                                                                                                                                                                                                                   |
| 4       | Project-Based Learning                   | Organize students into small groups to discuss complex topics, such as the ethical implications of data science.                                                                                                                                                                                        |
| 5       | Lectures and Interactive Discussions     | Provide clear, concise explanations of key concepts, theories, and algorithms in each module. Use visual aids, such as slides and diagrams, to enhance understanding.                                                                                                                                   |

**4. Assessment Details (both CIE and SEE)**

**Continuous Internal Evaluation:**

**CIE Split up for Professional Elective-I (PE)**

|   | Components                    | Number | Weightage | Max. Marks |
|---|-------------------------------|--------|-----------|------------|
| 1 | Internal Assessment-Tests (A) | 3      | 50%       | 25         |
| 2 | Team Work (B)                 | 2      | 50%       | 25         |
|   | <b>Total Marks</b>            |        |           | <b>50</b>  |

**Final CIE Marks = (A) + (B)**

**A** = Average of best two Test marks

**B** = Average of two Term Work marks

**Self-Learning (SL):** If applicable, the teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The faculty must collect the certificate from the students who have successfully completed the self-learning relevant to the course.

**Semester End Examination:**

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

**5. Course Outcomes (COs) and Mapping with POs/ PSOs**

**Course Outcomes (COs)**

| COs                 | Description                                                              |
|---------------------|--------------------------------------------------------------------------|
| <b>M25BCS504B.1</b> | Compare cloud computing environment utilized for real time applications. |
| <b>M25BCS504B.2</b> | Identify various models of cloud computing.                              |
| <b>M25BCS504B.3</b> | Analyze how to design cloud native applications.                         |
| <b>M25BCS504B.4</b> | Examine the importance of Cloud Virtualization Technologies.             |

CO-PO-PSO Mapping

| COs/POs      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| M25BCS504B.1 | 3   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | 3    | 3    |
| M25BCS504B.2 | -   | 3   | -   | -   | -   | -   | -   | -   | -   | -    | -    | 3    | 3    |
| M25BCS504B.3 | -   | 3   | 3   | -   | -   | -   | -   | -   | -   | -    | -    | 3    | 3    |
| M25BCS504B.4 | 3   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | 3    | 3    |
| M25BCS504B   | 3   | 3   | 3   | -   | -   | -   | -   | -   | -   | -    | -    | 3    | 3    |

6. Mapping to Sustainable Development Goals (SDG):

| Sl. No. | SDG                                           | Justification                                                                                                                                                                                                   |
|---------|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | <b>SDG 4:</b> Quality Education               | Involves training in improve cloud accessibility, flexibility and cost effectiveness.                                                                                                                           |
| 2       | <b>SDG 8:</b> Decent Work and Economic Growth | Boosting productivity, creating new job opportunities and enables businesses, especially small and medium sized enterprises.                                                                                    |
| 3       | <b>SDG 10:</b> Reduced Inequalities           | Cloud computing can contribute to reduce inequalities in several ways including bridging the digital divide, providing access to educational resources and fostering economic opportunities for small business. |



|                                |                                                                        |                   |
|--------------------------------|------------------------------------------------------------------------|-------------------|
| <b>5<sup>th</sup> Semester</b> | <b>Professional Elective (PE)<br/>DATA MINING AND DATA WAREHOUSING</b> | <b>M25BIS504C</b> |
|--------------------------------|------------------------------------------------------------------------|-------------------|

**1. Prerequisites**

| Sl. No. | Proficiency                                           | Pre-requisites                                                                                                                                                                                                                |
|---------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Basic Science                                         | Understanding of DBMS concepts (like tables, keys, normalization, transactions). Ability to write SQL queries (SELECT, JOIN, GROUP BY, etc.). Familiarity with relational database systems like Oracle, MySQL, or PostgreSQL. |
| 2       | Mathematics (Linear Algebra & Calculus – Basic Level) | Basic understanding of <b>matrix operations</b> , vectors, etc. Useful in algorithms like PCA, SVD (used in dimensionality reduction in mining).                                                                              |
| 3       | Data Structures and Algorithms                        | Concepts such as arrays, linked lists, trees, graphs, stacks, and queues. Searching and sorting techniques (important for mining algorithms).                                                                                 |
| 4       | Fundamentals of Data Analysis                         | Data preprocessing (handling missing values, normalization, transformation).<br>Data visualization techniques (charts, histograms, scatter plots).                                                                            |

**2. Syllabus**

| <b>DATA MINING AND DATA WAREHOUSING<br/>SEMESTER – V</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                  |             |                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------|----------------|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>M25BIS504C</b>                | CIE Marks   | <b>50</b>      |
| Total Number of Teaching-Learning Hours/sem (L:T: P:TW:SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>32:32:0:16:20 = 100 Hours</b> | SEE Marks   | <b>50</b>      |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>03</b>                        | Total Marks | <b>100</b>     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                  | Exam Hours  | <b>03</b>      |
| <b>Course Objectives:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                  |             |                |
| <ol style="list-style-type: none"> <li>1. Introduction to general issues of Data Warehouse and Data Mining.</li> <li>2. Understanding of the different architectures and mining techniques</li> <li>3. The role and functions of Data Warehouse and Data Mining</li> <li>4. Explain the stages and process different data mining techniques.</li> <li>5. Learn mining and warehouse techniques through the use of different tools</li> </ol>                                                                                                                                                               |                                  |             |                |
| <b>Module -1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |             |                |
| Data Warehouse: Introduction to Data Warehouse, Differences between operational data base systems and data Warehouse, Data Warehouse characteristics, Data Warehouse Architecture and its components, Extraction Transformation-Loading, Logical (Multi- Dimensional), Data Modeling, Schema Design, star and snow-Flake Schema, Fact Constellation, Fact Table, Fully Addictive, Semi-Addictive, Non-Addictive Measures; Fact Less-Facts, Dimension Table characteristics; Fact-Less-Facts, Dimension Table characteristics; OLAP cube, OLAP Operations, OLAP Server Architecture-ROLAP, MOLAP and HOLAP. |                                  |             |                |
| <b>Textbook 2: Ch.4.1,4.2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                  |             | <b>8 hours</b> |
| <b>Module -2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |             |                |
| Introduction to Data Mining: Introduction, what is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Preprocessing- Data Cleaning, Missing Data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binarization, Data Transformation; Measures of similarity and Dissimilarity-Basics.                                                                                                                                                                                                                                                                                |                                  |             |                |
| <b>Textbook 2: Ch.4.4 Textbook 1: Ch.1.1,1.2,1.4, 2.1 to 2.4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |             | <b>8 hours</b> |
| <b>Module -3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |             |                |
| Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FPGrowth Algorithm, Evaluation of Association Patterns.                                                                                                                                                                                                                                                                                                                                                                              |                                  |             |                |
| <b>Textbook 1: Ch 6.1,6.2,6.3, 6.5, 6.6 and 6.7</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                  |             | <b>8 hours</b> |
| <b>Module -4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |             |                |
| Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                  |             |                |
| <b>Textbook 1: Ch 4.3,4.6,5.1,5.2,5.3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                  |             | <b>8 hours</b> |
| <b>Module -5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |             |                |
| Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms. <b>Textbook 1: Ch 8.1 to 8.5, 9.3 to 9.5</b>                                                                                                                                                                                                                                                                                                                                                                  |                                  |             | <b>8 hours</b> |
| <b>TEXT BOOKS:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                  |             |                |

2025 Scheme – 3<sup>rd</sup> to 8<sup>th</sup> Sem Competency Based Syllabus for B.E Information Science & Engineering

|                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------|
| 1. Pang-Ning Tan, Vipin Kumar, Michael Steinbach, <b>Introduction to Data Mining</b> , Pearson Education.                            |
| 2. Jiawei Han, Micheline Kamber, <b>Data Mining-Concepts and Techniques</b> , Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006. |
| <b>REFERENCE BOOKS:</b>                                                                                                              |
| 1. Arun K Pujari, Data Mining Techniques, 3rd Edition, Universities Press                                                            |
| 2. Pualraj Ponnaiah, Data Ware Housing Fundamentals, Wiley Student Edition                                                           |
| 3. Ralph Kimball, the Data Ware House Life Cycle Toolkit- Wiley Student Edition.                                                     |
| 4. Vikaram Pudi, P Radha Krishna, Data Mining, Oxford University                                                                     |
| <b>VIDEO LINKS:</b>                                                                                                                  |
| 1. <a href="https://nptel.ac.in/courses/106/106/106106093/">https://nptel.ac.in/courses/106/106/106106093/</a>                       |
| 2. <a href="https://nptel.ac.in/courses/106/105/106105174/">https://nptel.ac.in/courses/106/105/106105174/</a>                       |
| 3. <a href="https://nptel.ac.in/courses/110/107/110107092/">https://nptel.ac.in/courses/110/107/110107092/</a>                       |
| 4. VTU e-Shikshana Program                                                                                                           |

3. Teaching-Learning Process Strategies

| Sl. No. | TLP Strategies          | Description                                                                                                           |
|---------|-------------------------|-----------------------------------------------------------------------------------------------------------------------|
| 1       | Lecture Method          | Utilize various teaching methods within the lecture format to reinforce competencies.                                 |
| 2       | Video/Animation         | Incorporate visual aids like videos/animations to enhance understanding of concepts.                                  |
| 3       | Collaborative Learning  | Encourage collaborative learning for improved competency application.                                                 |
| 4       | Real-World Application  | Discuss practical applications to connect theoretical concepts with real-world competencies.                          |
| 5       | Flipped Class Technique | Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies |

4. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation:

CIE Split up for Professional elective (PE)

| Components  |                               | Number | Weightage | Max. Marks |
|-------------|-------------------------------|--------|-----------|------------|
| 1           | Internal Assessment-Tests (A) | 3      | 50%       | 25         |
| 2           | Team Work (B)                 | 2      | 50%       | 25         |
| Total Marks |                               |        |           | 50         |

Final CIE Marks = (A) + (B)

A = Average of best two Test marks

B = Average of two Term Work marks

**Self-Learning (SL):** If applicable, the teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The faculty must collect the certificate from the students who have successfully completed the self-learning relevant to the course.

Semester End Examination:

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks



5. Course Outcomes (COs) and Mapping with POs/ PSOs

Course Outcomes (COs)

| COs          | Description                                                                                      |
|--------------|--------------------------------------------------------------------------------------------------|
| M25BCS504C.1 | Understand the functionality of the various data mining and data warehousing component           |
| M25BCS504C.2 | Apply the strengths and limitations of various data mining and data warehousing models           |
| M25BCS504C.3 | Analyse the different methodologies used in classification.                                      |
| M25BCS504C.4 | Evaluate the different approaches of data warehousing and data mining with various technologies. |

CO-PO-PSO Mapping

| COs/POs      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| M25BCS504C.1 | 3   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 2    |
| M25BCS504C.2 | -   | 3   | -   | -   | -   | -   | -   | -   | -   | -    | -    | 2    | -    |
| M25BCS504C.3 | -   | -   | 3   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 2    |
| M25BCS504C.4 | -   | -   | -   | 3   | -   | -   | -   | -   | -   | -    | -    | -    | 2    |
| M25BCS504C   | 3   | 3   | 3   | 3   | -   | -   | -   | -   | -   | -    | -    | 2    | 2    |

6. Mapping to Sustainable Development Goals (SDG):

| Sl. No. | SDG                                                    | Justification                                                                                                                       |
|---------|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| 1       | <b>SDG 3:</b> Good Health and Well-being               | Data mining in healthcare helps in disease prediction, patient monitoring, and improving healthcare delivery using historical data. |
| 2       | <b>SDG 4:</b> Quality Education                        | Warehousing educational data supports personalized learning and early warning systems for dropout risks using data mining.          |
| 3       | <b>SDG 9:</b> Industry, Innovation, and Infrastructure | Data infrastructure (like warehouses) supports innovation and smart industry practices.                                             |



| 5 <sup>th</sup> Semester |                                      | Professional Elective (PE)<br>ADVANCED JAVA                                                                                                                                                                                           | M25BCS504D |
|--------------------------|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 1. Prerequisites         |                                      |                                                                                                                                                                                                                                       |            |
| S/L                      | Proficiency                          | Prerequisites                                                                                                                                                                                                                         |            |
| 1                        | Basic Computer Skills                | Familiarity with operating systems, file management, and general computer usage.                                                                                                                                                      |            |
| 2                        | Discrete Mathematics                 | A basic understanding of set theory, logic, and relational algebra can be helpful, especially when dealing with queries and data relationships.                                                                                       |            |
| 3                        | Fundamentals of Data and Information | Familiarize yourself with the concepts of data, information, and knowledge. Understand the differences between structured and unstructured data.                                                                                      |            |
| 4                        | Understanding of Data Structures     | Knowledge of basic data structures (like arrays, linked lists, stacks, queues, trees, and graphs) is important for understanding how data is organized and accessed.                                                                  |            |
| 5                        | Programming Skills                   | Proficiency in at least one programming language (such as Python, Java, or C++) is beneficial, as many DBMS systems provide APIs or require procedural code for database manipulation.                                                |            |
| 6                        | Basic SQL Knowledge                  | Familiarity with SQL (Structured Query Language) is essential, as it is the standard language for interacting with relational databases. SQL Structures including Joins, Sub-Queries, Set-Operations, Stored Procedures and triggers. |            |
| 7                        | Database Design and Modelling        | Expertise in designing database schemas, normalization, de-normalization, data modeling techniques & query optimization.                                                                                                              |            |

| ADVANCED JAVA<br>SEMESTER – V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |             |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------|-----|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | M25BCS504D                | CIE Marks   | 50  |
| Total Number of Teaching-Learning Hours/sem<br>(L:T: P:TW:SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 32:32:0:16:20 = 100 Hours | SEE Marks   | 50  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                           | Total Marks | 100 |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 03                        | Exam Hours  | 03  |
| <b>Course Objectives:</b> <ul style="list-style-type: none"><li>1. Understanding the fundamental concepts of Enumerations and Annotations</li><li>2. Apply the concepts of Generic classes in Java programs</li><li>3. Demonstrate the fundamental concepts of String operations</li><li>4. Design and develop web applications using Java servlets and JSP</li><li>5. Apply database interaction through Java database Connectivity</li></ul>                                                                                                                                                                                                                                                                                |                           |             |     |
| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                           |             |     |
| <b>Enumerations:</b> Enumeration fundamentals, The values() and value Of() methods, Java Enumerations are Class Types, Enumerations inherit Enum, Type Wrappers.<br><b>Autoboxing:</b> Autoboxing and Methods, Autoboxing/Unboxing Occurs in Expressions, Autoboxing / Unboxing Boolean and Character values, Autoboxing/Unboxing Helps Prevent Errors, A word of Warning.<br><b>Annotations:</b> Annotation Basics, Specifying a Retention Policy, Obtaining Annotations at Run Time by Use of Reflection, The Annotated Element Interface, Using default values, Marker Annotations, Single-Member Annotations, The Built-In Annotations.<br><b>Text Book-1: Chapter-12</b> <span style="float:right"><b>8 hours</b></span> |                           |             |     |
| <b>Module-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                           |             |     |
| <b>String Handling:</b> The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf(), Changing the Case of Characters Within a String, String Buffer.<br><b>Text Book-1: Chapter-15</b> <span style="float:right"><b>8 hours</b></span>                                                                                                                                                                                                                                                                                                                                                                 |                           |             |     |
| <b>Module-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                           |             |     |
| <b>The Applet Class:</b> Two Types of Applets, Applet Basics, Applet Architecture, An Applet Skeleton, Simple                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |             |     |



2025 Scheme – 3<sup>rd</sup> to 8<sup>th</sup> Sem Competency Based Syllabus for B.E Information Science & Engineering

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Applet Display Methods, Requesting Repainting, Using Status Window, HTML Applet Tag, Passing Parameters to Applets.<br><b>Introducing Swings:</b> Two Key Swing Features, Components and Containers, A Simple Swing Application, Event Handling, Creating Swing Applet.<br><b>Exploring Swings:</b> JLabel and ImageIcon, JTextField, The Swing Buttons-Jbutton, JtoggleButton, Check Boxes, Radio Buttons.<br><b>Text Book-1: Selected Topics from Chapter-22, Chapter-30, Chapter-31</b> <b>8 hours</b>      |  |
| <b>Module-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| <b>Servlets:</b> The Life Cycle of a Servlet, A Simple Servlet; The Servlet API; The javax.servlet Package, Reading Servlet Parameters, The javax.servlet.http Package, Handling HTTP Requests and Responses, Using Cookies; Session Tracking.<br><b>Java Server Pages:</b> JSP Tags - Variables and Objects, Methods, Control Statements, Loops, Request String - Parsing Other Information, User Sessions, Cookies, Session Objects<br><b>Text Book-1: Chapter-32 Text Book-2: Chapter-11</b> <b>8 hours</b> |  |
| <b>Module-5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| <b>JDBC Objects:</b> The Concept of JDBC, JDBC Driver Types, JDBC Packages; A Brief Overview of the JDBC Process, Database Connection, Associating the JDBC/ODBC Bridge with the Database, Statement Objects, ResultSet, Transaction Processing, Data Types.<br><b>Text Book-2: Chapter-6</b> <b>8 hours</b>                                                                                                                                                                                                   |  |
| <b>TEXTBOOKS:</b><br>1. Herbert Schildt, Java - The Complete Reference, 8th Edition, Tata McGraw-Hill.<br>2. Jim Keogh, The Complete Reference J2EE, Tata McGraw-Hill<br><b>REFERENCE BOOKS:</b><br>1. Y. Daniel Liang, Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007<br>2. Steven Holzner, Java-2 Programming Black Book, McGraw-Hill Education.                                                                                                                                     |  |

3. Teaching-Learning Process Strategies

| S/L | TLP Strategies:                         | Description                                                                                                                                                                                                                                                                                                  |
|-----|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Problem-Based Learning                  | Engage students with real-world problems that require advanced Java knowledge to solve. It Encourages deep understanding, critical thinking, and application of complex Java concepts in practical situations.                                                                                               |
| 2   | Hands-On Coding Sessions                | Incorporate frequent coding exercises where students write, debug, and optimize Java code. Projects which could include building scalable web applications. It will enhance coding proficiency and reinforces theoretical knowledge through practical application                                            |
| 3   | Use of Frameworks and Libraries         | Introduce and work extensively with popular Java frameworks such as Spring, Hibernate, and Apache Kafka. Teach students how to integrate these tools into their projects. This will helps the students to prepare for industry demands, as these frameworks are widely used in enterprise-level development. |
| 4   | Flipped Classroom Model                 | Assign reading or video lectures as homework, and use class time for discussions, problem-solving sessions, and hands-on activities.                                                                                                                                                                         |
| 6   | Regular Assessments and Feedback        | Conduct quizzes, coding challenges, and peer assessments to regularly gauge student understanding. Provide detailed feedback to guide improvement.                                                                                                                                                           |
| 7   | Guest Lectures and Industry Interaction | Invite industry professionals to give talks on current trends, challenges, and opportunities in Java development. Arrange for students to work on live projects or case studies from the industry.                                                                                                           |



4. Assessment Details (both CIE and SEE)

Continuous Internal Evaluation:

CIE Split up for Professional Course (PC)

| Components  |                               | Number | Weightage | Max. Marks |
|-------------|-------------------------------|--------|-----------|------------|
| 1           | Internal Assessment-Tests (A) | 3      | 50%       | 25         |
| 2           | Team Work (B)                 | 2      | 50%       | 25         |
| Total Marks |                               |        |           | 50         |

Final CIE Marks = (A) + (B)

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**Self-Learning (SL):** The teaching faculty shall motivate the students to take up online courses from any recognized platforms. There shall not be any assessment of the Self-Learning component. The faculty must collect the certificate from the students who have successfully completed the self-learning relevant to the course.

Semester End Examination:

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 question from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. Marks scored will be proportionally scaled down to 50 marks

5. Course Outcomes (COs) and Mapping with POs/ PSOs

Course Outcomes (COs)

| COs          | Description                                                                                                                   |
|--------------|-------------------------------------------------------------------------------------------------------------------------------|
| M25BCS504D.1 | Understand and apply the basic concept of interfaces, classes and scripting constructs of advanced java and J2EE              |
| M25BCS504D.2 | Apply appropriate collection framework methods, string handling techniques and scripting constructs for web-based application |
| M25BCS504D.3 | Analyse the advanced concepts of java programming and the concepts of J2EE to enhance the java programming techniques         |
| M25BCS504D.4 | Design and implement web application using advanced concepts of java and server-side scripting using database drivers         |

CO-PO-PSO Mapping

| COs/POs      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| M25BCS504D.1 | 3   | -   | -   | -   | -   | -   | -   | -   | -   | -    | -    | 3    | -    |
| M25BCS504D.2 | 3   | -   | -   | -   | 2   | -   | -   | -   | -   | -    | -    | 3    | 3    |
| M25BCS504D.3 | -   | 3   | -   | -   | 2   | -   | -   | -   | -   | -    | -    | -    | 3    |
| M25BCS504D.4 | -   | -   | -   | 3   | 2   | -   | -   | -   | -   | -    | -    | 3    | 3    |
| M25BCS504D   | 3   | 3   | -   | 3   | 2   | -   | -   | -   | -   | -    | -    | 3    | 3    |

6. Mapping to Sustainable Development Goals (SDG):

| Sl. No. | SDG                                    | Justification                                                                                                                                                                                                                                                         |
|---------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | SDG 4: Quality Education               | Advanced Java programming education, which equips learners with skills in software development. Providing accessible, high-quality education in programming fosters digital literacy and technical skills, enabling individuals to participate in the modern economy. |
| 2       | SDG 8: Decent Work and Economic Growth | Proficiency in Advanced Java programming prepares individuals for careers in software development, a high-demand field. This contributes to economic growth by creating job opportunities and                                                                         |

2025 Scheme – 3<sup>rd</sup> to 8<sup>th</sup> Sem Competency Based Syllabus for B.E Information Science & Engineering

|   |                                                        |                                                                                                                                                                                                                                        |
|---|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   |                                                        | fostering innovation.                                                                                                                                                                                                                  |
| 3 | <b>SDG 9:</b> Industry, Innovation, and Infrastructure | Advanced Java is widely used in building robust, scalable applications and these technologies support the development of resilient digital infrastructure and foster innovation in industries like finance, healthcare, and education. |
| 4 | <b>SDG 17:</b> Partnerships for the Goals              | Java is a foundational language for many open-source, academic, and enterprise technology projects. Knowledge of Java encourages collaborative development and global digital partnerships.                                            |



|                                |                                           |                  |
|--------------------------------|-------------------------------------------|------------------|
| <b>5<sup>th</sup> Semester</b> | <b>Project Work (PW)<br/>MINI PROJECT</b> | <b>M25BIS505</b> |
|--------------------------------|-------------------------------------------|------------------|

### 1. Prerequisites

| Sl. No. | Proficiency                                                 | Pre-requisites                                                                                                                                     |
|---------|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Basic Engineering Principles                                | Fundamental courses in the information science and engineering stream                                                                              |
| 2       | Application of Theoretical Knowledge in Practical Scenarios | Knowledge of the core subjects of the information science and engineering stream                                                                   |
| 3       | Project Design and Planning                                 | Familiarity with design tools and project management techniques.                                                                                   |
| 4       | Multidisciplinary Collaboration                             | Basic knowledge of related disciplines (e.g., information science and engineering students should have a basic understanding of Programming etc.). |
| 5       | Technical Communication                                     | Writing technical reports and presenting technical content                                                                                         |

### 2. Assessment Details (both CIE and SEE)

#### Continuous Internal Evaluation:

- The CIE marks awarded for the mini-project shall be based on the committee's evaluation of the mini-project work and the respective guide, as mentioned below.
- The marks awarded for the mini-project report shall be the same for all the students of the batch. The faculty guide/mentor guiding the mini-project shall evaluate the report for 50% of the maximum marks of CIE.

#### Mini Project Evaluation for CIE

| Sl. No.      | Description                | % Marks     | In Marks   |
|--------------|----------------------------|-------------|------------|
| 1            | Report writing             | 50%         | 50         |
| 2            | Project presentation skill | 25%         | 25         |
| 3            | Viva-Voce                  | 25%         | 25         |
| <b>Total</b> |                            | <b>100%</b> | <b>100</b> |

### 3. Course Outcomes (COs) and Mapping with POs/ PSOs

#### Course Outcomes (COs)

| COs                | Description                                                                             |
|--------------------|-----------------------------------------------------------------------------------------|
| <b>M25BIS505.1</b> | Apply engineering principles to identify, formulate, and solve real-world problems.     |
| <b>M25BIS505.2</b> | Design and develop prototypes or models that address specific engineering challenges.   |
| <b>M25BIS505.3</b> | Collaborate with team members to complete the project successfully.                     |
| <b>M25BIS505.4</b> | Document and present the project effectively, demonstrating clear communication skills. |

#### CO-PO-PSO Mapping

| COs/POs            | PO1      | PO2      | PO3      | PO4      | PO5      | PO6      | PO7      | PO8      | PO9      | PO10     | PO11     | PSO1     | PSO2     |
|--------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| <b>M25BIS505.1</b> | 3        | -        | -        | -        | -        | -        | -        | -        | -        | -        | -        | -        | -        |
| <b>M25BIS505.2</b> | -        | -        | 3        | -        | -        | -        | -        | -        | -        | -        | -        | -        | -        |
| <b>M25BIS505.3</b> | -        | -        | -        | -        | 3        | -        | -        | -        | -        | -        | -        | -        | -        |
| <b>M25BIS505.4</b> | -        | -        | -        | -        | -        | -        | -        | -        | -        | 3        | -        | -        | -        |
| <b>M25BIS505</b>   | <b>3</b> | <b>-</b> | <b>3</b> | <b>-</b> | <b>3</b> | <b>-</b> | <b>-</b> | <b>-</b> | <b>-</b> | <b>3</b> | <b>-</b> | <b>-</b> | <b>-</b> |

4. Mapping to Sustainable Development Goals (SDG):

| Sl. No. | SDG                                             | Justification                                                 |
|---------|-------------------------------------------------|---------------------------------------------------------------|
| 1       | SDG 4<br>(Quality Education)                    | Indirect link via knowledge dissemination.                    |
| 2       | SDG 9<br>(Industry, Innovation, Infrastructure) | Solves real-world technical problems.                         |
| 3       | SDG 7<br>(Affordable Energy)                    | Depends on project theme (e.g., renewable energy prototypes). |
| 4       | SDG 11<br>(Sustainable Cities)                  |                                                               |
| 5       | SDG 17<br>(Partnerships)                        | Teamwork supports collaborative goals.                        |



|                          |                                                                                                      |                   |
|--------------------------|------------------------------------------------------------------------------------------------------|-------------------|
| 5 <sup>th</sup> Semester | <b>Ability Enhancement Course (AE)<br/>RESEARCH METHODOLOGY AND<br/>INTELLECTUAL PROPERTY RIGHTS</b> | <b>M25BRMK506</b> |
|--------------------------|------------------------------------------------------------------------------------------------------|-------------------|

**1. Prerequisites**

| Sl. No. | Proficiency                                  | Pre-requisites                                                                                                                                                                                                                                                                                     |
|---------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Basic Understanding of Research Concepts     | Before delving into the specifics of engineering research and intellectual property rights, students should have a foundational understanding of what research is, its objectives, and its significance, particularly in the context of engineering.                                               |
| 2       | Familiarity with Ethics in Research          | Basic knowledge of ethics, including common ethical dilemmas and misconduct in research, is essential. This includes understanding issues related to authorship and ethical considerations in the research process.                                                                                |
| 3       | Literature Review Skills                     | Students should have prior experience in conducting literature reviews, including familiarity with bibliographic databases such as Web of Science, Google Scholar, and effective search strategies. This will help them in understanding and analyzing existing knowledge in their research field. |
| 4       | Introduction to Intellectual Property Rights | A preliminary understanding of intellectual property rights, including patents, copyrights, trademarks, and industrial designs, would be beneficial. This knowledge should include the role of IP in society and basic IP laws, especially in the Indian context.                                  |
| 5       | Technical Reading and Writing Skills         | Competence in reading and comprehending technical documents, including research papers, datasheets, and legal texts, is crucial. Additionally, students should have basic knowledge of how to structure a journal paper and the importance of proper citation and attribution in academic writing. |

**2. Syllabus**

| <b>RESEARCH METHODOLOGY &amp; INTELLECTUAL PROPERTY RIGHTS<br/>SEMESTER – V</b>                                                                                                                                                                                                                                                                                                                                                                                               |                                    |             |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-------------|------------|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>M25BRMK506</b>                  | CIE Marks   | <b>50</b>  |
| Total Number of Teaching-Learning Hours/sem<br>(L:T:P:TW:SL)                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>32: 32: 0: 16: 0 = 80 Hours</b> | SEE Marks   | <b>50</b>  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                    | Total Marks | <b>100</b> |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>03</b>                          | Exam Hours  | <b>03</b>  |
| <b>Course Objectives:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                    |             |            |
| <ol style="list-style-type: none"> <li>To know the meaning of engineering research.</li> <li>To know the procedure of Literature Review and Technical Reading.</li> <li>To know the fundamentals of patent laws and drafting procedure.</li> <li>To gain awareness of the copyright laws and subject matters of copyrights and designs.</li> <li>To interpret and learn the basic principles of design rights.</li> </ol>                                                     |                                    |             |            |
| <b>Module -1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                    |             |            |
| <b>Introduction:</b> Meaning of research, objectives of engineering research, and motivation in engineering research, types of engineering research, finding and solving a worthwhile problem.                                                                                                                                                                                                                                                                                |                                    |             |            |
| <b>Ethics in engineering research:</b> Ethics in engineering research practice, types of research misconduct, and ethical issues related to authorship.                                                                                                                                                                                                                                                                                                                       |                                    |             |            |
| <b>Module -2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                    |             |            |
| <b>Journal Paper document: structure and approach, Literature Review and Technical Reading:</b> New and existing knowledge in research field, analysis and synthesis of prior art. Bibliographic databases like web of science, Google and Google scholar. Effective search: the way forward, introduction to technical reading conceptualizing research, critical and creative reading, taking notes while reading, reading mathematics and algorithms, reading a datasheet. |                                    |             |            |
| <b>Attributions and Citations:</b> Giving credit wherever due, citations: functions and attributes, impact of title and keywords on citations, knowledge flow through citation, styles for citations, citing datasets, acknowledgments and attributions, what should be acknowledged, acknowledgments in books and dissertations, dedication vs. acknowledgments.                                                                                                             |                                    |             |            |
| <b>Module -3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                    |             |            |

**Introduction to Intellectual Property (IP):** Role of IP in the economic and cultural development of the society, IP governance, IP as a global indicator of innovation, origin of IP, history of IP in India. Major amendments IP laws and acts in India. IP Organizations in India, schemes and programs.

**Patents:** Conditions for obtaining a patent protection, to patent or not to patent an invention. Rights associated with patents and enforcement of patent rights. Non-patentable matters. Patent infringements and avoiding public disclosure of an invention before patenting.

**Process of Patenting:** Prior art search, choice of application to be filed, patent application forms, fee structure, types of patent applications. Jurisdiction of filing patent application, publication, pre-grant opposition, examination, and grant of a patent. Validity of patent protection, post-grant opposition, and commercialization of a patent. Need for a patent attorney/ agent. Can a worldwide patent be obtained? Do I need first to file a patent in India? Commonly used terms in patenting, National bodies dealing with patent affairs, utility models.

**Case Studies on Patents.** Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent.

#### Module -4

**Copyrights and Related Rights:** Classes of copyrights, criteria for copyright, ownership of copyright, and copyrights of the author. Copyright infringement a criminal offence and cognizable offence. Fair use doctrine. Copyrights and internet. Non-copyright work. Copyright registration. Judicial powers of the registrar of copyrights. Fee structure, copyright symbol, validity of copyright, copyright profile of India. Transfer of copyrights to a publisher. Copyrights and the words 'adaptation', 'Indian work', 'joint authorship', 'publish'. Copyright society, copyright board, and copyright enforcement advisory council (CEAC). International copyright agreements, conventions and treaties.

**Case Studies of Copyrights cases:** Hawkins Cooker Ltd. vs. Magicook Appliances, KSRTC copyright case.

**Trademarks registration:** prior art search, eligibility criteria, who can apply for a trademark. Acts and laws. Designation of trademark symbols. Classification of trademarks. Registration of a trademark is not compulsory. Validity of trademark. Types of trademark registered in India. Trademark registry and process for trademarks registration. **Case Studies on Trademarks:** Coca-cola company vs. Bisleri international PVT. Ltd, and Yahoo! Inc. vs. Akash Arora & Anr

#### Module -5

**Industrial Designs:** Eligibility criteria, Acts and laws to govern industrial designs. Design rights. Enforcement of design rights. Non-protectable industrial designs India. Protection term. Procedure for registration of industrial designs: Prior art search, application for registration, duration of the registration of a design. Importance of design registration. Cancellation of the registered design. Application forms. Classification of industrial designs. Designs registration trend in India. International treaties.

**Famous case of:** Apple inc. vs. Samsung electronics co.

**Geographical Indications (GI):** acts, laws and rules pertaining to GI. Ownership of GI. Rights granted to the holders. Registered GI in India. Identification of registered GI. Classes of GI. Non-registerable GI. Protection of GI. Collective or certification marks. Enforcement of GI rights. Procedure for GI registration documents required for GI registration. GI ecosystem in India.

**Case Studies on GI tags:** Case Study of Mysore Silk, Darjeeling Tea, Kancheepuram Silk Sarees, case of Goa's Feni

#### Text Books:

1. Dipankar Deb • Rajeeb Dey, Valentina E. Balas "Engineering Research Methodology", ISSN 1868-4394 ISSN 1868-4408 (electronic), Intelligent Systems Reference Library, ISBN 978-981-13-2946-3 ISBN 978-981-13-2947-0 (eBook), <https://doi.org/10.1007/978-981-13-2947-0>
2. KOTHARI, C. R. (2004). "Research methodology: Methods and techniques". New age international.
3. Intellectual Property A Primer for Academia by Prof. Rupinder Tewari Ms. Mamta Bhardwa

#### Reference Book:

1. David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488-4
2. Intellectual Property Rights by N.K. Acharya Asia Law House 6th Edition. ISBN: 978-93 81849-30-9

**3. Teaching-Learning Process Strategies**

| Sl. No. | TLP Strategies          | Description                                                                                                           |
|---------|-------------------------|-----------------------------------------------------------------------------------------------------------------------|
| 1       | Lecture Method          | Utilize various teaching methods within the lecture format to reinforce competencies.                                 |
| 2       | Video/Animation         | Incorporate visual aids like videos/animations to enhance understanding of research methodology concepts.             |
| 3       | Collaborative Learning  | Encourage collaborative learning for improved competency application.                                                 |
| 4       | Real-World Application  | Discuss practical applications to connect theoretical concepts with real-world competencies.                          |
| 5       | Flipped Class Technique | Utilize a flipped class approach, providing materials before class to facilitate deeper understanding of competencies |

**4. Assessment Details (both CIE and SEE)****Continuous Internal Evaluation:**

|   | Components                    | Number | Weightage | Max. Marks |
|---|-------------------------------|--------|-----------|------------|
| 1 | Internal Assessment-Tests (A) | 3      | 50%       | 25         |
| 2 | Team Work (B)                 | 2      | 50%       | 25         |
|   | <b>Total Marks</b>            |        |           | <b>50</b>  |

**Final CIE Marks = (A) + (B)****A** = Average of best two Test marks**B** = Average of two Term Work marks**Semester End Examination:**

1. Question paper pattern will be ten questions. Each question is set for 20marks. The medium of the question paper shall be English unless otherwise it is mentioned.
2. There shall be 2 questions from each module, each of the two questions under a module (with a maximum of 3 sub questions), may have mix of topics under that module if necessary.
3. The students have to answer 5 full questions selecting one full question from each module.
4. The question paper may include one question from the laboratory component.
5. Marks scored will be proportionally scaled down to 50 marks

**5. Course Outcomes (COs) and Mapping with POs/ PSOs****Course Outcomes (COs)**

| COs                 | Description                                                                                                                                                                                                                                  |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>M25BRMK506.1</b> | Interpret the ethical issues in engineering research, including identifying types of research misconduct and evaluating the impact of ethical practices on research outcomes.                                                                |
| <b>M25BRMK506.2</b> | Analyze literature from diverse bibliographic databases, critically appraise existing research, and synthesize prior art to develop a comprehensive understanding of a chosen research topic.                                                |
| <b>M25BRMK506.3</b> | Apply appropriate citation styles and techniques, ensuring proper attributions in academic writing to maintain ethical standards and enhance the credibility of research work.                                                               |
| <b>M25BRMK506.4</b> | Apply the principles of intellectual property rights, including patents, copyrights, and trademarks, to assess the eligibility of an invention or creative work for protection, and navigate the processes for registration and enforcement. |
| <b>M25BRMK506.5</b> | Analyze the role of intellectual property in economic and cultural development, and explain the historical evolution and contemporary relevance of IP laws and acts, particularly in the Indian context.                                     |

**CO-PO-PSO Mapping**

| COs/POs             | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| <b>M25BRMK506.1</b> | 3   | -   | -   | 3   | -   | -   | -   | 3   | -   | -    | 3    | 3    | -    |
| <b>M25BRMK506.2</b> | -   | 3   | -   | 3   | 3   | -   | -   | -   | -   | 3    | 3    | 3    | -    |
| <b>M25BRMK506.3</b> | -   | -   | -   | -   | 3   | -   | -   | 3   | -   | 3    | 3    | -    | 3    |
| <b>M25BRMK506.4</b> | -   | 3   | -   | 3   | -   | -   | -   | -   | -   | 3    | -    | 3    |      |

|                     |   |   |   |   |   |   |   |   |   |   |   |   |
|---------------------|---|---|---|---|---|---|---|---|---|---|---|---|
| <b>M25BRMK506.5</b> | - | - | - | - | - | 3 | - | - | - | - | - | 3 |
| <b>M25BRMK506</b>   | 3 | 3 | - | 3 | 3 | 3 | - | 3 | - | 3 | 3 | 3 |

**6. Mapping to Sustainable Development Goals (SDG):**

| <b>Sl. No.</b> | <b>SDG</b>                                                            | <b>Justification</b>                                       |
|----------------|-----------------------------------------------------------------------|------------------------------------------------------------|
| 1              | <b>SDG 4</b> (Quality Education)                                      | Enhances research literacy and critical thinking.          |
| 2              | <b>SDG 8</b> (Decent Work),<br><b>SDG 17</b> (Partnerships)           | IP-driven economic growth and global collaborations.       |
| 3              | <b>SDG 9</b> (Innovation),<br><b>SDG 12</b> (Responsible Consumption) | IPR fosters innovation and protects sustainable solutions. |
| 4              | <b>SDG 16</b> (Peace & Justice)                                       | Promotes ethical research integrity.                       |

|                                |                                                                           |                   |
|--------------------------------|---------------------------------------------------------------------------|-------------------|
| <b>5<sup>th</sup> Semester</b> | <b>Professional Core Course Laboratory (PCL)<br/>SOFTWARE TESTING LAB</b> | <b>M25BISL507</b> |
|--------------------------------|---------------------------------------------------------------------------|-------------------|

**1. Prerequisites**

| S/L | Proficiency           | Prerequisites                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Hardware Requirements | Computers/Workstations: Adequate number of computers with varying specifications to test software on different configurations.<br>Servers: For testing server-based applications, load balancing, and stress testing.<br>Network Infrastructure: Routers, switches, and cabling for connecting computers and servers.<br>Mobile Devices: For testing mobile applications, you'll need a range of smartphones and tablets. |
| 2   | Software Requirements | Operating Systems: Different OS versions for compatibility testing (e.g., Windows, Linux, macOS).<br>Browsers: Various web browsers for cross-browser testing (e.g., Chrome, Firefox, Edge, Safari).<br>Testing Tools:<br>Automated Testing Tools: Selenium, QTP, etc.<br>Performance Testing Tools: JMeter, Load Runner, etc.<br>Bug Tracking Tools: Jira, Bugzilla, etc.<br>Version Control Systems: Git, SVN, etc      |
| 3   | Network Configuration | Local Area Network (LAN): To connect the devices within the lab.<br>Internet Connectivity: For accessing online resources, updates, and cloud-based services.<br>Firewall and Security: Proper configurations to protect the lab network.                                                                                                                                                                                 |
| 4   | Test Data             | Sample Data: For testing purposes, including various input scenarios, user data, and load data.<br>Data Management Tools: For generating and managing test data.                                                                                                                                                                                                                                                          |
| 5   | Documentation         | Test Plans: Detailed plans outlining the scope, approach, resources, and schedule for testing activities.<br>Test Cases: Specific conditions under which testing will be performed.<br>Test Scripts: Automated scripts used for testing.                                                                                                                                                                                  |
| 6   | Human Resources       | Testers/Engineers: Skilled professionals who perform the testing.<br>Developers: To fix any issues identified during testing.<br>System Administrators: To manage and maintain hardware and software.                                                                                                                                                                                                                     |
| 7   | Environment Setup     | Test Environment: A controlled setup that mimics the production environment as closely as possible.<br>Backup and Recovery: Procedures and tools to ensure data integrity and recovery in case of failure.                                                                                                                                                                                                                |

**2. Syllabus**

| <b>SOFTWARE TESTING LAB<br/>SEMESTER – V</b>                                                                                                                                                                                                                                                                                                                                                                                                                         |                              |             |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------|------------|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>M25BISL507</b>            | CIE Marks   | <b>50</b>  |
| Total Number of Teaching-Learning Hours/sem<br>(L:T:P:TW:SL)                                                                                                                                                                                                                                                                                                                                                                                                         | <b>0:0:32:0:0 = 32 Hours</b> | SEE Marks   | <b>50</b>  |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>01</b>                    | Total Marks | <b>100</b> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                              | Exam Hours  | <b>03</b>  |
| <b>Course objectives:</b> This course will enable students to: <ol style="list-style-type: none"> <li>1. Explain the test cases for any given problem</li> <li>2. Analyze the requirements for the given problem statement.</li> <li>3. Design the solution and write test cases for the given problem.</li> <li>4. Construct control flow graphs for the solution that is implemented.</li> <li>5. Create appropriate document for the software artifact</li> </ol> |                              |             |            |
| <b>Sl.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>PART A</b>                |             |            |

| No                                       | List of problems for which student should develop program and execute in the Laboratory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                                        | You have joined a software development firm that builds solutions for retail management systems. One of your first assignments is to develop a <b>commission calculator</b> for the company's sales department. This calculator determines the monthly commission for sales representatives based on their total sales. Design, develop, code and run the program in any suitable language to solve the commission problem. Analyse it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.                                                                                                                                                                                                                                                                                                                                                            |
| 2                                        | NextDate is a function of three variables: month, date, and year. It returns the date of the day after the input date. The month, date, and year variables have integer values subject to the given conditions. Design, develop, code and run the program in any suitable language to implement the Next Date function. Analyse it from the perspective of equivalence class value testing, derive different test cases, execute these test cases and discuss the test results.                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 3                                        | A retail company has employed sales representatives who earn a commission based on their monthly sales amount. As a software engineer, you have been asked to <b>develop a system that calculates the commission</b> earned by a salesperson. Design, develop, code and run the program in any suitable language to solve the commission problem. Analyse it from the perspective of decision table-based testing, derive different test cases, execute these test cases and discuss the test results.                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 4                                        | Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Design and develop a program in a language of your choice to solve the triangle problem and derive test cases for your program based on boundary-value analysis, equivalence class partitioning and decision-table approach and execute the test cases and discuss the results.                                                                                                                                                                                                                                                                                                                                                            |
| 5                                        | You have joined a software development firm that builds solutions for retail management systems. One of your first assignments is to develop a <b>commission calculator</b> for the company's sales department. This calculator determines the monthly commission for sales representatives based on their total sales. Design, develop, code and run the program in any suitable language to solve the commission problem. Analyse it from the perspective of dataflow testing, derive different test cases, execute these test cases and discuss the test results.                                                                                                                                                                                                                                                                                                                                                                  |
| 6                                        | You are working as a junior software engineer at a tech startup that is developing an efficient inventory lookup system. The backend team needs a fast algorithm to search for product IDs from a sorted list of thousands of items. Your team leader has asked you to implement the Binary Search algorithm to perform this operation with optimal time complexity. To ensure that the implementation is correct and all logical paths are covered, your task includes not just coding, but also conducting <b>basis path testing</b> by determining independent paths and creating corresponding test cases. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.                                                                                                                                                                                           |
| <b>PART B – Practical Based Learning</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 7                                        | <p>Develop a Mini Project with documentation of suitable test-cases and their results to perform automation testing of any E-commerce or social media web page. 03092022</p> <p>Suggested Guidelines:</p> <ul style="list-style-type: none"> <li>• Create a WebDriver session.</li> <li>• Navigate to a Web page.</li> <li>• Locate the web elements on the navigated page.</li> <li>• Perform an actions on the located elements.</li> <li>• Assert the performed actions did the correct thing.</li> <li>• Report the results of the assertions.</li> <li>• End the session.</li> </ul> <p>Each inputs / data feeds (ex: website, username, password, mobile no, product name, etc.,) must be provided through a file linked with code and neither to be entered manually nor to be included in the code. Use any software testing tool like selenium, Katalon, etc. Measurement of gear tooth profile using gear tooth Vernier</p> |

**3. Teaching-Learning Process Strategies**

| S/L | TLP Strategies:         | Description                                                                                                     |
|-----|-------------------------|-----------------------------------------------------------------------------------------------------------------|
| 1   | Interactive Lectures    | Use interactive lectures to introduce new concepts. Incorporate questions and discussions to engage students.   |
| 2   | Coding Sessions         | Demonstrate the implementation of different Testing live, showing step-by-step coding and debugging.            |
| 3   | Lab Exercises           | Design lab exercises that require students to implement and manipulate Testing process.                         |
| 4   | Coding Assignments      | Assign regular coding tasks that reinforce lecture material and provide practical experience.                   |
| 5   | Group Projects          | Encourage students to work in groups for larger projects, fostering teamwork and collaborative problem-solving. |
| 6   | Code Documentation      | Practice writing clear and comprehensive documentation for all coding assignments and projects.                 |
| 7   | Programming Assignments | Assign programming tasks and mini projects to reinforce practical skills associated with competencies.          |

**4. Assessment Details (both CIE and SEE)****Lab Test Marks Distribution**

| Sl. No.      | Description                                                    | % Marks     | In Marks   |
|--------------|----------------------------------------------------------------|-------------|------------|
| 1            | Write-up, Conduction, Result and Procedure/Algorithm/Flowchart | 60%         | 60         |
| 2            | Viva-Voce                                                      | 40%         | 40         |
| <b>Total</b> |                                                                | <b>100%</b> | <b>100</b> |

**Final CIE Marks Distribution:**

| Sl. No.      | Description                                     | % Marks            | In Marks  |
|--------------|-------------------------------------------------|--------------------|-----------|
| 1            | Scaled Down marks of conduction, record/journal | 60% of the maximum | 30        |
| 2            | Scaled-down marks of the test                   | 40% of the maximum | 20        |
| <b>Total</b> |                                                 | <b>100%</b>        | <b>50</b> |

**SEE for the Practical Course:**

1. All laboratory experiments are to be included for practical examination.
2. Students are allowed to pick one experiment from list of the experiment
3. A change of experiment/program is allowed only once, and 20% of the marks allotted to the procedure/write-up part will be zero.
4. The duration of SEE shall be 3 hours.
5. SEE marks for a practical course shall be 50 marks.
6. The practical course is evaluated for 100 marks, and the scored marks shall be scaled down to 50 marks.
7. 50% of the marks allotted for lab experiment execution and remaining 50% marks for the project demonstration.

**Marks distribution for the PART-A Conduction**

| SL. No.             | Description           | % Marks    | Marks     |
|---------------------|-----------------------|------------|-----------|
| 1                   | Write-up, Procedure   | 10%        | 10        |
| 2                   | Conduction and result | 30%        | 30        |
| 3                   | Viva-Voce             | 10%        | 10        |
| <b>Total-Part-A</b> |                       | <b>50%</b> | <b>50</b> |

**Marks distribution for the PART-B Conduction**

| SL. No.             | Description                   | % Marks    | Marks      |
|---------------------|-------------------------------|------------|------------|
| 1                   | PPT presentation              | 10%        | 10         |
| 2                   | Demonstration of Mini-Project | 30%        | 30         |
| 3                   | Viva-Voce                     | 10%        | 10         |
| <b>Total-Part-B</b> |                               | <b>50%</b> | <b>50%</b> |

**5. Course Outcomes (COs) and Mapping with POs/ PSOs****Course Outcomes (COs)**

| <b>Cos</b>          | <b>Description</b>                                                               |
|---------------------|----------------------------------------------------------------------------------|
| <b>M25BISL507.1</b> | Apply the suitable testing techniques for a given problem.                       |
| <b>M25BISL507.2</b> | Analyze the prerequisites for a given problem by writing appropriate test cases. |
| <b>M25BISL507.3</b> | Execute the test cases to solve a given problem.                                 |
| <b>M25BISL507.4</b> | Create appropriate document for the software artifact.                           |

**CO-PO-PSO Mapping**

| <b>COs/Pos</b>      | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PSO1</b> | <b>PSO2</b> |
|---------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|
| <b>M25BISL507.1</b> | 2          | -          | -          | -          | -          | -          | -          | -          | -          | -           | -           | 2           | -           |
| <b>M25BISL507.2</b> | -          | 3          | -          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 2           |
| <b>M25BISL507.3</b> | -          | 2          | 2          | -          | -          | -          | -          | -          | -          | -           | -           | -           | 3           |
| <b>M25BISL507.4</b> | -          | -          | -          | 2          | -          | -          | -          | -          | 2          | -           | -           | -           | -           |
| <b>M25BISL507</b>   | <b>3</b>   | <b>2.5</b> | <b>2</b>   | <b>2</b>   | <b>-</b>   | <b>-</b>   | <b>-</b>   | <b>-</b>   | <b>2</b>   | <b>-</b>    | <b>-</b>    | <b>2</b>    | <b>2.5</b>  |

**6. Mapping to Sustainable Development Goals (SDG):**

| <b>Sl. No.</b> | <b>SDG</b>                                      | <b>Justification</b>                                                                                                                            |
|----------------|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| 1              | SDG 4 – Quality Education                       | Offer hands-on experience in software quality assurance (QA). Promote training in automation tools, ethical hacking, accessibility testing, etc |
| 2              | SDG 9 – Industry, Innovation and Infrastructure | Develop and test reliable software for industrial and infrastructure needs. Collaborate with industry to solve real-world testing problems.     |
| 3              | SDG 10 – Reduced Inequalities                   | Prioritize accessibility testing (e.g., screen readers, mobile usability). Engage testers from diverse backgrounds and ensure inclusive hiring. |

|                          |                                                          |             |
|--------------------------|----------------------------------------------------------|-------------|
| 5 <sup>th</sup> Semester | Non-Credit Mandatory Course (NMC)<br>INDIAN CONSTITUTION | M25BICOK508 |
|--------------------------|----------------------------------------------------------|-------------|

## 1. Syllabus

| INDIAN CONSTITUTION<br>SEMESTER – V                                                                                                                                                                                                                                                                                                                                                                                                 |                           |             |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------|----|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                         | M25BICOK508               | CIE Marks   | 50 |
| Total Number of Teaching-Learning Hours/sem<br>(L:T:P:TW:SL)                                                                                                                                                                                                                                                                                                                                                                        | 16: 0: 0: 0: 0 = 16 Hours | SEE Marks   | -  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                     |                           | Total Marks | 50 |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                             | 00                        | Exam Hours  | -  |
| <b>Course Objectives:</b>                                                                                                                                                                                                                                                                                                                                                                                                           |                           |             |    |
| 1. To know about the basic structure of Indian Constitution.<br>2. To know the Fundamental Rights (FR's), DPSP's and Fundamental Duties (FD's) of our constitution.<br>3. To know about our Union Government, political structure & codes, procedures.<br>4. To know the State Executive & Elections system of India.<br>5. To learn the Amendments and Emergency Provisions, other important provisions given by the constitution. |                           |             |    |
| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                     |                           |             |    |
| Indian Constitution: Necessity of the Constitution, Societies before and after the Constitution adoption. Introduction to the Indian constitution, Making of the Constitution, Role of the Constituent Assembly.                                                                                                                                                                                                                    |                           |             |    |
| <b>Module -2</b>                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |             |    |
| Salient features of India Constitution: Preamble of Indian Constitution & Key concepts of the Preamble. Fundamental Rights (FR's) and its Restriction and limitations in different Complex Situations.                                                                                                                                                                                                                              |                           |             |    |
| <b>Module -3</b>                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |             |    |
| Directive Principles of State Policy (DPSP's) and its present relevance in Indian society. Fundamental Duties And its Scope and significance in Nation, Union Executive: Parliamentary System, Union Executive-President, Prime Minister, Union Cabinet.                                                                                                                                                                            |                           |             |    |
| <b>Module -4</b>                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |             |    |
| Parliament-LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Judicial System of India, Supreme Court of India and other Courts, Judicial Reviews and Judicial Activism.                                                                                                                                                                                                                                   |                           |             |    |
| <b>Module -5</b>                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |             |    |
| State Executive and Governor, CM, State Cabinet, Legislature-VS & VP, Election Commission, Elections & Electoral Process. Amendment to Constitution, and Important Constitutional Amendments till today. Emergency Provisions.                                                                                                                                                                                                      |                           |             |    |
| <b>TEXTBOOK:</b>                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |             |    |
| "Introduction to the Constitution of India" by D.D. Basu                                                                                                                                                                                                                                                                                                                                                                            |                           |             |    |
| <b>REFERENCE BOOK:</b>                                                                                                                                                                                                                                                                                                                                                                                                              |                           |             |    |
| "Constitution of India" by V.N. Shukla                                                                                                                                                                                                                                                                                                                                                                                              |                           |             |    |

## 2. Teaching-Learning Process Strategies

| Sl. No. | TLP Strategies         | Description                                                                           |
|---------|------------------------|---------------------------------------------------------------------------------------|
| 1       | Lecture Method         | Utilize various teaching methods within the lecture format to reinforce competencies. |
| 2       | Activity based         | Group discussion topics                                                               |
| 3       | Collaborative Learning | Visit the Government office and parliament                                            |
| 4       | Writing exercises      | Essay writing                                                                         |
| 5       | Real-World Application | Discuss Elections & Electoral                                                         |

**3. Assessment Details (both CIE and SEE)****CIE Split up:**

| Components         |                               | Number | Weightage | Max. Marks |
|--------------------|-------------------------------|--------|-----------|------------|
| 1                  | Internal Assessment-Tests (A) | 3      | 50%       | 25         |
| 2                  | Team Work (B)                 | 2      | 50%       | 25         |
| <b>Total Marks</b> |                               |        |           | <b>50</b>  |

- 1) The CIE question paper shall have MCQ set for 25 questions, each carrying one mark.
- 2) The average internal assessment shall be the average of the 2 best marks in the tests conducted
- 3) The SEE question paper shall have MCQ set for 50 questions, each carrying one mark.
- 4) The time duration for SEE is one hour.

**4. Course Outcomes (COs) and Mapping with POs/ PSOs****Course Outcomes (COs)**

| COs                  | Description                                                                                             |
|----------------------|---------------------------------------------------------------------------------------------------------|
| <b>M25BICOK508.1</b> | Analyse the basic structure of Indian Constitution.                                                     |
| <b>M25BICOK508.2</b> | Understand our State Executive & Elections system of India.                                             |
| <b>M25BICOK508.3</b> | Remember their Fundamental Rights, DPSP's and Fundamental Duties (FD's) of our constitution.            |
| <b>M25BICOK508.4</b> | Remember the Amendments and Emergency Provisions, other important provisions given by the constitution. |

**5. Mapping to Sustainable Development Goals (SDG):**

| Sl. No. | SDG                                          | Justification                                                                                                                                                                      |
|---------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | SDG 4 (Quality Education),                   | Fundamental Rights/Duties promote inclusive education and equity.                                                                                                                  |
| 2       | SDG 10 (Reduced Inequalities)                | Fundamental Rights/Duties promote inclusive education and equity.                                                                                                                  |
| 3       | SDG 16 (Peace, Justice, Strong Institutions) | Strengthens understanding of democratic institutions. Elections and governance indirectly support institutional integrity. Emergency provisions are niche to governance stability. |

|                          |                                                            |            |
|--------------------------|------------------------------------------------------------|------------|
| 5 <sup>th</sup> Semester | Non-Credit Mandatory Course (NMC)<br>ENVIRONMENTAL STUDIES | M25BBEK508 |
|--------------------------|------------------------------------------------------------|------------|

## 1. Syllabus

| ENVIRONMENTAL STUDIES<br>SEMESTER – V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                           |             |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------|----|
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | M25BBEK508                | CIE Marks   | 50 |
| Total Number of Teaching-Learning Hours/sem<br>(L:T:P:TW:SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 16: 0: 0: 0: 0 = 16 Hours | SEE Marks   | -  |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 00                        | Total Marks | 50 |
| Exam Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                           |             |    |
| -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                           |             |    |
| <b>Course Objectives:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                           |             |    |
| 1. Understand the structure and function of various ecosystems like forests, deserts, wetlands, rivers, oceans, and lakes.<br>2. Explore natural resource management techniques, including energy systems and disaster management, and assess their sustainability.<br>3. Examine environmental pollution sources and impacts, and learn corrective and preventive measures alongside waste management strategies.<br>4. Investigate global environmental issues such as climate change and groundwater depletion, and the role of environmental legislation in addressing these issues. |                           |             |    |
| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                           |             |    |
| <b>ECOSYSTEMS (STRUCTURE AND FUNCTION):</b> Forest, Desert, Wetlands, River, Oceanic and Lake. Sustainability: 17 SDGs- History, targets, implementation, Capacity Development                                                                                                                                                                                                                                                                                                                                                                                                           |                           |             |    |
| <b>Module -2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                           |             |    |
| <b>NATURAL RESOURCE MANAGEMENT</b><br>Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind. Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining - case studies and Carbon Trading.                                                                                                                                                                                                                                                                                           |                           |             |    |
| <b>Module -3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                           |             |    |
| <b>ENVIRONMENTAL POLLUTION &amp; WASTE MANAGEMENT</b> Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution. Waste Management: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.                                                                                                                                                                                                  |                           |             |    |
| <b>Module -4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                           |             |    |
| <b>Global Environmental Concerns</b> (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.                                                                                                                                                                                                                                                                                                             |                           |             |    |
| <b>Module -5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                           |             |    |
| <b>ENVIRONMENTAL LEGISLATION</b> : Water Act 1974, Air Act 1981, Environmental Protection Act 1984, Solid Waste Management Rules-2016, E- Waste management Rule - 2022, Biomedical Waste management- 2016. Environmental Impact Assessment                                                                                                                                                                                                                                                                                                                                               |                           |             |    |
| <b>TEXTBOOKS:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                           |             |    |
| 1. Environmental studies, Benny Joseph, Tata Mcgraw-Hill 2nd edition 2012<br>2. Environmental studies, S M Prakash, pristine publishing house, Mangalore 3rd edition-2018                                                                                                                                                                                                                                                                                                                                                                                                                |                           |             |    |
| <b>REFERENCE BOOKS:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                           |             |    |
| 1. Benny Joseph, Environmental studies, Tata Mcgraw-Hill 2nd edition 2009<br>2. M.Ayi Reddy Textbook of environmental science and Technology, BS publications 2007<br>3. Dr. B.S Chauhan, Environmental studies, university of science press 1st edition                                                                                                                                                                                                                                                                                                                                 |                           |             |    |
| <b>VIDEO LINKS:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                           |             |    |
| <a href="https://sdgs.un.org/goals">https://sdgs.un.org/goals</a> Video Lectures<br><a href="https://archive.nptel.ac.in/courses/109/105/109105190/">https://archive.nptel.ac.in/courses/109/105/109105190/</a>                                                                                                                                                                                                                                                                                                                                                                          |                           |             |    |

**2. Teaching-Learning Process Strategies**

| Sl. No. | TLP Strategies            | Description                                                                                                                                                                            |
|---------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Interactive Lectures:     | Utilize chalk and talk along with PowerPoint presentations and animations to engage students in theoretical and practical understanding                                                |
| 2       | Case Study Analysis       | Present real-world scenarios and case studies to help students apply theoretical knowledge to practical situations, particularly in natural resource management and pollution control. |
| 3       | Fieldwork and Site Visits | Encourage hands-on learning through field visits to environmental labs, green buildings, and treatment plants, followed by documentation and analysis of the processes observed.       |
| 4       | Collaborative Learning    | Promote group projects and discussions, enabling students to collaborate and learn from each other, particularly in global environmental concerns and energy systems.                  |

**3. Assessment Details (both CIE and SEE)**

CIE Split up:

|   | Components                    | Number | Weightage | Max. Marks |
|---|-------------------------------|--------|-----------|------------|
| 1 | Internal Assessment-Tests (A) | 3      | 50%       | 25         |
| 2 | Team Work (B)                 | 2      | 50%       | 25         |
|   | <b>Total Marks</b>            |        |           | <b>50</b>  |

- 1) The CIE question paper shall have MCQ set for 25 questions, each carrying one mark.
- 2) The average internal assessment shall be the average of the 2 best marks in the tests conducted
- 3) The SEE question paper shall have MCQ set for 50 questions, each carrying one mark.
- 4) The time duration for SEE is one hour.

**4. Course Outcomes (COs)**

| Cos                 | Description                                                                                                   |
|---------------------|---------------------------------------------------------------------------------------------------------------|
| <b>M25BBEK508.1</b> | Analyze the structure and functions of various ecosystems and evaluate their sustainability.                  |
| <b>M25BBEK508.2</b> | Apply knowledge of natural resource management and advances in energy systems to assess their global impacts. |
| <b>M25BBEK508.3</b> | Investigate environmental pollution sources and apply waste management strategies in real-world scenarios.    |
| <b>M25BBEK508.4</b> | Critically analyze global environmental concerns and assess the effectiveness of environmental policies.      |
| <b>M25BBEK508.5</b> | Demonstrate an understanding of environmental legislation and apply it to ensure sustainable practices.       |

**5. Mapping to Sustainable Development Goals (SDG):**

| Sl. No. | SDG                                                                          | Justification                                            |
|---------|------------------------------------------------------------------------------|----------------------------------------------------------|
| 1       | <b>SDG 3</b> (Good Health),<br><b>SDG 13</b> (Climate Action)                | Addresses climate change, ozone depletion, and toxics.   |
| 2       | <b>SDG 6</b> (Clean Water),<br><b>SDG 11</b> (Sustainable Cities)            | Pollution control and waste management.                  |
| 3       | <b>SDG 7</b> (Affordable Energy),<br><b>SDG 12</b> (Responsible Consumption) | Renewable energy systems and carbon trading.             |
| 4       | <b>SDG 15</b> (Life on Land),<br><b>SDG 14</b> (Life Below Water)            | Covers forest, wetland, and oceanic ecosystems.          |
| 5       | <b>SDG 16</b> (Peace & Justice),<br><b>SDG 17</b> (Partnerships)             | Legislation supports governance and global partnerships. |

|                          |                                                                                                         |                  |
|--------------------------|---------------------------------------------------------------------------------------------------------|------------------|
| 5 <sup>th</sup> Semester | <b>Non-Credit Mandatory Course (NCMC)<br/>PROFESSIONAL AND PERSONALITY<br/>DEVELOPMENT TRAINING – I</b> | <b>M25BPK509</b> |
|--------------------------|---------------------------------------------------------------------------------------------------------|------------------|

**1. Prerequisites**

| Sl. No. | Proficiency                  | Pre-requisites                                                                                                                                                        |
|---------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Knowledge of English         | Basic knowledge of English both speaking and writing (referring to courses Professional Writing Skills in English (M25BPWSK110), Communicative English (M25BENGK209)) |
| 2       | Fundamentals of Engg. domain | Fundamentals of domain Engg to which the student belongs to so that he will be able to take technical topics for GD as well technical interview                       |
| 3       | Aptitude                     | Basic mathematics topics used with Aptitude test (referring to course of 3 <sup>rd</sup> sem, Mathematical & Logical Reasoning (M25BPK408))                           |

**2. Syllabus**

| <b>PROFESSIONAL AND PERSONALITY DEVELOPMENT TRAINING - I<br/>SEMESTER – V</b>                                                                                                         |                                  |             |           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------|-----------|
| Course Code                                                                                                                                                                           | <b>M25BPK509</b>                 | CIE Marks   | <b>50</b> |
| Total Number of Teaching-Learning Hours/sem<br>(L:T:P:TW:SL)                                                                                                                          | <b>16: 0: 0: 0: 0 = 16 Hours</b> | SEE Marks   | -         |
| Credits                                                                                                                                                                               | <b>00</b>                        | Total Marks | <b>50</b> |
| <b>Exam Hours</b>                                                                                                                                                                     |                                  |             |           |
| -                                                                                                                                                                                     |                                  |             |           |
| <b>Course Objectives:</b>                                                                                                                                                             |                                  |             |           |
| 1. To, develop problem solving skills                                                                                                                                                 |                                  |             |           |
| 2. To learn presentation skills both in group and individually                                                                                                                        |                                  |             |           |
| 3. To learn importance of Team work and team contribution                                                                                                                             |                                  |             |           |
| 4. To develop skills to handle conflicts, manage time & stress                                                                                                                        |                                  |             |           |
| 5. To develop adaptability and ability to handle emotions                                                                                                                             |                                  |             |           |
| <b>Module-1</b>                                                                                                                                                                       |                                  |             |           |
| Problem solving, creativity, critical thinking                                                                                                                                        |                                  |             |           |
| <b>Module -2</b>                                                                                                                                                                      |                                  |             |           |
| Body language, Presentation skills, Group Presentation                                                                                                                                |                                  |             |           |
| <b>Module -3</b>                                                                                                                                                                      |                                  |             |           |
| Time Management, Stress Management, Conflict Management                                                                                                                               |                                  |             |           |
| <b>Module -4</b>                                                                                                                                                                      |                                  |             |           |
| Leadership skills and Team Work                                                                                                                                                       |                                  |             |           |
| <b>Module -5</b>                                                                                                                                                                      |                                  |             |           |
| Adaptability and Emotion Intelligence                                                                                                                                                 |                                  |             |           |
| <b>Resources:</b>                                                                                                                                                                     |                                  |             |           |
| <a href="https://www.highpoint.edu/careerinternships/files/2014/08/NEW-Interview-Guide-2.pdf">https://www.highpoint.edu/careerinternships/files/2014/08/NEW-Interview-Guide-2.pdf</a> |                                  |             |           |

**3. Teaching-Learning Process Strategies**

| Sl. No. | TLP Strategies         | Description                                                                                    |
|---------|------------------------|------------------------------------------------------------------------------------------------|
| 1       | Lecture Method         | Utilize various teaching methods within the lecture format to reinforce competencies.          |
| 2       | Video/Animation        | Incorporate visual aids like videos/animations to enhance understanding of Important concepts. |
| 3       | Collaborative Learning | Encourage collaborative learning for improved competency development                           |
| 4       | Case-Study discussions | Discuss Case studies to connect theoretical concepts with real-world competencies.             |

|   |                         |                                                                        |
|---|-------------------------|------------------------------------------------------------------------|
| 5 | Activity based learning | Involve students in various activities connected with defined concepts |
|---|-------------------------|------------------------------------------------------------------------|

**4. Assessment Details (both CIE and SEE)****CIE Split up:**

| Components         |                               | Number | Weightage | Max. Marks |
|--------------------|-------------------------------|--------|-----------|------------|
| 1                  | Internal Assessment-Tests (A) | 3      | 50%       | 25         |
| 2                  | Team Work (B)                 | 2      | 50%       | 25         |
| <b>Total Marks</b> |                               |        |           | <b>50</b>  |

- 1) The CIE question paper shall have MCQ set for 25 questions, each carrying one mark.
- 2) The average internal assessment shall be the average of the 2 best marks in the tests conducted

**5. Course Outcomes (COs) and Mapping with POs/ PSOs****Course Outcomes (COs)**

| COs                 | Description                                                                       |
|---------------------|-----------------------------------------------------------------------------------|
| <b>M25BPDK509.1</b> | Apply fundamentals of communication to Group & Individual presentations concepts. |
| <b>M25BPDK509.2</b> | Analyze problems to correlate with theoretical concepts.                          |
| <b>M25BPDK509.3</b> | Evaluate Cases to arrive at better solution.                                      |
| <b>M25BPDK509.4</b> | Experiential learning through participation in activities .                       |

**6. Mapping to Sustainable Development Goals (SDG):**

| Sl. No. | SDG                                  | Justification                                        |
|---------|--------------------------------------|------------------------------------------------------|
| 1       | <b>SDG 5:</b> Gender equality        | Group discussions without gender difference in group |
| 2       | <b>SDG 11:</b> Reduced inequality    | Activities formed for group without any inequalities |
| 3       | <b>SDG 17:</b> Partnership for Goals | Team activities to understand partnership for goals  |