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| **Engineering Mathematics** | | | |
| **Course Code:** | | **Maximum marks : 100** | |
| **L-P-E: 3-0-0** | **Total Credits: 3** | | **Total Contact Hours: 45** |
| **Semester: I** | | | |
| **Prerequisites (if any): NA** | | | |
| **Introduction:**  This is a foundational course for computer science students that introduces the mathematical concepts and techniques essential to computer science. The course covers topics such as logic, sets, functions, relations, combinatorics, graph theory, and number theory. It emphasises problem-solving, critical thinking, and effective communication of mathematical ideas | | | |
| **Course Outcomes:** On completion of the course, students will be able to: | | | |
| |  |  |  | | --- | --- | --- | | **COs** | **Course outcomes** | **RBT** | | **CO1** | Explain the fundamental concepts and principles of discrete mathematics, including logic, sets, functions, and relations. | L2 | | **CO2** | Summarise mathematical ideas and solutions clearly and effectively, both orally and in writing. | L2 | | **CO3** | Outline discrete mathematics concepts to create mathematical models for real-world problems, such as scheduling and network optimization | L2 | | **CO4** | Apply MATLAB to solve systems of linear equations and compute eigenvalues/vectors of matrices | L3 | | **CO5** | Make use of discrete mathematics concepts to solve problems in computer science. | L3 | | | | |
| **Syllabus** | | | |
| **Module-1 - 9 hours** | | | |
| **Matrices and its Operations**  Rank of a matrix, Echelon form, creating matrices in MATLAB. System of linear equations- Consistency, Solution by Gauss elimination with the help of toolbox. Eigenvalues and Eigenvectors of square matrices using inbuilt function in the tools. | | | |
| **Module – 2 - 9 hours** | | | |
| **Proofs**  Introduction and Proofs, Induction, Strong Induction, Number Theory | | | |
| **Module – 3 - 9 hours** | | | |
| **Structures**  Graph theory and Colouring, Matching Problems, Minimum Spanning Tree, Communication Networks, Directed graphs, Relations and partial orders, State machines | | | |
| **Module-4 - 9 hours** | | | |
| **Counting**  Sums, asymptotics, Divide and Conquer Recurrences, Linear Recurrences, Counting Rules, Generating functions, Infinite sets | | | |
| **Module-5 - 9 hours** | | | |
| **Probability**  Introduction to Probability, Conditional Probability, Independence, Random variables, Expectations, Deviations, Random Walks | | | |
| **Textbooks:**   * B V Ramana; Higher Engineering Mathematics, 12th Reprint Edition, 2018. * Mathematics for Computer Science; Eric Lehman, F Thomson Leighton, Albert R Meyer; 12th Media Services (5 June 2017)   **Reference Books:**   * Erwin Kreyszig; Advanced Engineering Mathematics; 9th Edition, 2012. * Discrete Mathematics and Its Application; Kenneth H Rosen & Dr Kamala Krithivasan; McGraw Hill; 8th edition * A Textbook on Discrete Mathematics; CV Sastry and Rakesh Nayak; Wiley (1 October 2020)   **Course Assessment:**  There shall be two components of grading in the assessment of each course:  CIA- Continuous Internal Assessments  SEE- Semester End Exam  CIA: - The CIA is conducted during the semester at regular intervals. This component  represents the formative assessment of students' learning. At an aggregate, CIA will carry 50 marks, after due scaling. To pass the CIA, a student must score min 40% (in other words, 20 out of 50 in CIA) in the aggregate CIA score. This score of min 40% is also required to become eligible for attending SEE.  Semester-End Examination (SEE): This component represents the summative assessment carried  out in the form of an examination conducted at the end of the semester. SEE will carry 50 marks, after due scaling. To pass SEE, a student score min 40% (in other words, 20 out of 50 in SEE).  Marks obtained in CIA and SEE components have equal weightage (CIA: 50 and SEE: 50) in  determining the final marks and grades obtained by a student in a Course. | | | |

# **Semester 1**

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| **Engineering Physics** | | | |
| **Course Code:** | | **Maximum marks: 100** | |
| **L-P-E: 3-0-0** | **Total Credits: 3** | | **Total Contact Hours: 45** |
| **Semester: I** | | | |
| **Prerequisites (if any):** NA | | | |
| **Introduction:**  Engineering Physics blends fundamental physics with engineering applications. Covering mechanics, electromagnetism, and thermodynamics, this course explores key scientific principles and their technological impacts. Students will delve into semiconductors, fibre optics, and laser technology, with practical programming exercises to simulate physical phenomena. This course equips students with the knowledge to innovate in the tech-driven world. | | | |
| **Course Outcomes:** On completion of the course, students will be able to: | | | |
| |  |  |  | | --- | --- | --- | | **COs** | **Course outcomes** | **RBT** | | **CO1** | Explain the basic principles of physics such as mechanics, electromagnetism and thermodynamics. | L2 | | **CO2** | Interpret the relationship between physics and technology, especially in advancements such as semiconductors and optimal fibres for communication. | L2 | | **CO3** | Explain the impact of physics and technology on society. | L2 | | **CO4** | Apply concepts of physics practically in the domain of computer science. | L3 | | **CO5** | Simulate concepts of physics in coding by writing programs to simulate concepts such as mechanics and motion. | L3 | | | | |
| **Syllabus** | | | |
| **Module-1 - 9 hours** | | | |
| **Introduction to Science and Technology**  Definition and characteristics of science; Relationship between science and technology; Historical development of science and technology; Ethical considerations in science and technology | | | |
| **Module – 2 - 9 hours** | | | |
| **Principles of Mechanics and Electromagnetism**  Mechanics: Concepts of motion, forces, work, energy, momentum; Electromagnetism: electric fields, magnetic fields, electromagnetic waves | | | |
| **Module – 3 - 9 hours** | | | |
| **Principles of Thermodynamics**  Laws of thermodynamics, heat transfer, phase transitions | | | |
| **Module-4 - 9 hours** | | | |
| **Physics in Computer Science**  Semiconductors: materials and working principle, Fibre optics and laser, Optical fibre as a dielectric waveguide, Undersea optical fibre networks, Losses associated with optical fibres, Applications of optical fibres | | | |
| **Module-5 - 9 hours** | | | |
| **Simulating Concepts of Physics**  Writing programs to simulate mechanics and motion, latency/speed-of-light communication, Interplanetary communication, Deep-space networks (Voyager and other mission, moon and mars missions | | | |
| **Textbooks:**   * Halliday & Resnick Principles of Physics, Extended, 12ed; Halliday, Resnick, and Walker; Wiley India   **Reference Books:**   * Interplanetary flight and communication Vol1- NA Rynin   **Course Assessment:**  There shall be two components of grading in the assessment of each course:  CIA- Continuous Internal Assessments  SEE- Semester End Exam  CIA: - The CIA is conducted during the semester at regular intervals. This component  represents the formative assessment of students' learning. At an aggregate, CIA will carry 50 marks, after due scaling. To pass the CIA, a student must score min 40% (in other words, 20 out of 50 in CIA) in the aggregate CIA score. This score of min 40% is also required to become eligible for attending SEE.  Semester-End Examination (SEE): This component represents the summative assessment carried  out in the form of an examination conducted at the end of the semester. SEE will carry 50 marks, after due scaling. To pass SEE, a student score min 40% (in other words, 20 out of 50 in SEE).  Marks obtained in CIA and SEE components have equal weightage (CIA: 50 and SEE: 50) in  determining the final marks and grades obtained by a student in a Course. | | | |

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| **Frontend Web Development Basics** | | | |
| **Course Code:** | | **Maximum marks: 100** | |
| **L-P-E: 1-6-0** | **Total Credits: 4** | | **Total Contact Hours: 105** |
| **Semester: I** | | | |
| **Prerequisites (if any):** NA | | | |
| **Introduction:**  In this course, students will learn the fundamentals of Frontend Web Development, including HTML, CSS and JavaScript. They will learn how to create responsive and dynamic web pages, as well as develop their problem-solving and critical thinking skills. The course will focus on hands-on projects and exercises to give students practical experience in front-end web development. | | | |
| **Course Outcomes:** On completion of the course, students will be able to: | | | |
| |  |  |  | | --- | --- | --- | | **COs** | **Course outcomes** | **RBT** | | **CO1** | Apply debugging tools and techniques to identify and fix errors in web applications. | L3 | | **CO2** | Apply concepts of HTML, CSS and JavaScript for the development of interactive and responsive web pages. | L3 | | **CO3** | Summarize the principles of web design and user experience. | L2 | | **CO4** | Apply the principles of web design and user experience in building web pages. | L3 | | **CO5** | Design web pages that are accessible, user-friendly, and optimised for search engines | L6 | | **CO6** | Create reusable code components to improve productivity and maintainability. | L6 | | | | |
| **Syllabus** | | | |
| **Module-1 - 21 hours** | | | |
| **HTML, CSS Basics**  Environment set up, Introduction to HTML, HTML Block Elements, HTML Inline Elements, HTML Forms, Introduction to CSS, CSS Font & Text, CSS Selectors, CSS Inheritance, CSS Colors | | | |
| **Module – 2 - 21 hours** | | | |
| **Javascript Basics**  Introduction to JS, JS Variables, JS Data Types, Basics of JS Operators, Basics of JS Strings, Basics of JS Conditional Statements, Basics of JS Control Statements, Basics of JS Arrays, Basics of JS Functions, Basics of JS Objects | | | |
| **Module – 3 - 21 hours** | | | |
| **HTML, CSS Advanced**  CSS Advanced Selectors, CSS Positioning, Advanced Flexbox, CSS Grids, Box Model, Flex Box | | | |
| **Module-4 - 21 hours** | | | |
| **Javascript Advanced**  JS DOM, JS Advanced Functions, JS Nested Data Structures, JS Higher Order Functions, JS Event Handling, Object Oriented JS, JS Closure, JS Storage | | | |
| **Module-5 - 21 hours** | | | |
| **Building a Project**  Application in a project: Building a project using all concepts learnt. | | | |
| **Textbooks:**   * Web development: This book includes: Web development for Beginners in HTML + Web design with CSS + Javascript basics for Beginners; Andy Vickler; Ladoo Publishing LLC (24 May 2021) * The Road to Learn React: Your Journey to Master Plain Yet Pragmatic React.Js; Robin Wieruch; Zaccheus Entertainment (1 January 2018   **Reference Books:**   * "HTML, CSS, and JavaScript All in One; Julie C. Meloni & Jennifer Kyrnin; Pearson Education; Third edition * React and React Native: A complete hands-on guide to modern web and mobile development with React.js; Adam Boduch & Roy Derks; Packt Publishing Limited; 3rd edition.   **Course Assessment:**  There shall be two components of grading in the assessment of each course:  CIA- Continuous Internal Assessments  SEE- Semester End Exam  CIA: - The CIA is conducted during the semester at regular intervals. This component  represents the formative assessment of students' learning. At an aggregate, CIA will carry 50 marks, after due scaling. To pass the CIA, a student must score min 40% (in other words, 20 out of 50 in CIA) in the aggregate CIA score. This score of min 40% is also required to become eligible for attending SEE.  Semester-End Examination (SEE): This component represents the summative assessment carried  out in the form of an examination conducted at the end of the semester. SEE will carry 50 marks, after due scaling. To pass SEE, a student score min 40% (in other words, 20 out of 50 in SEE).  Marks obtained in CIA and SEE components have equal weightage (CIA: 50 and SEE: 50) in  determining the final marks and grades obtained by a student in a Course. | | | |

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| **Problem Solving using Programming - 1** | | | |
| **Course Code:** | | **Maximum marks: 100** | |
| **L-P-E: 1-6-0** | **Total Credits: 4** | | **Total Contact Hours: 105** |
| **Semester: I** | | | |
| **Prerequisites (if any):** NA | | | |
| **Introduction:**  Problem Solving using Programming is an introductory course that teaches fundamental programming concepts and techniques using C++ and Python. The course emphasises problem-solving skills and computational thinking and equips students with the skills necessary to tackle real-world problems using programming. | | | |
| **Course Outcomes:** On completion of the course, students will be able to: | | | |
| |  |  |  | | --- | --- | --- | | **COs** | **Course outcomes** | **RBT** | | **CO1** | Explain fundamental programming concepts, including data types, control structures, and functions | L2 | | **CO2** | Apply programming constructs to solve simple problems and algorithms in C++ and Python. | L3 | | **CO3** | Model programming constructs to develop larger programs that solve complex problem. | L3 | | **CO4** | Apply the concepts of basic data structures like arrays in solving problems. | L3 | | **CO5** | Analyse the efficiency and correctness of algorithms and programs. | L4 | | **CO6** | Simplify programming solutions clearly and effectively, both orally and in writing. | L4 | | | | |
| **Syllabus** | | | |
| **Module-1 - 21 hours** | | | |
| **Algorithms**  Computational thinking, Decomposition, Abstraction, Pattern Recognition, Algorithms, Writing pseudocode and translating it to code, Looping (While and do-while loops) | | | |
| **Module – 2 - 21 hours** | | | |
| **Basics of Programming**  Variables (Scope, lifetime and Initialization), Datatypes (Structures, classes, enums), Operators (Arithmetic operators, Relational operators, Logical operators, Bitwise operators & Assignment operators), Using constants to represent fixed values in code; local and global variables, and their uses and limitations; operator precedence, order of evaluation, and short-circuiting | | | |
| **Module – 3 - 21 hours** | | | |
| **Strings and Arrays**  Introduction to strings and advanced string manipulation techniques, such as concatenation, substring extraction, searching, and replacing; Introduction to characters including ASCII and Unicode encoding, character classification functions, and character mapping | | | |
| **Module-4 - 21 hours** | | | |
| **Control Flow Statements - Conditional**  If, If else, for loop & while loop; using boolean expressions to control program flow and evaluate conditions; using switch statements to select one of many possible code paths based on a value or condition | | | |
| **Module-5 - 21 hours** | | | |
| **Control Flow Statements - Looping**  Introduction to repetition and loops, types of loops, loops with multiple variables, nested loops, iteration and higher order functions. | | | |
| **Textbooks:**   * "Think Like a Programmer: An Introduction to Creative Problem Solving by V. Anton Spraul, Released August 2012, published by No Starch Press.   **Reference Books:**   * Programming in Python 3: A Complete Introduction to the Python Language; Mark Summerfield; Pearson Education; Second edition * C++ Programming Language; Bjarne Stroustrup; Pearson Education; 4th edition.   **Course Assessment:**  There shall be two components of grading in the assessment of each course:  CIA- Continuous Internal Assessments  SEE- Semester End Exam  CIA: - The CIA is conducted during the semester at regular intervals. This component  represents the formative assessment of students' learning. At an aggregate, CIA will carry 50 marks, after due scaling. To pass the CIA, a student must score min 40% (in other words, 20 out of 50 in CIA) in the aggregate CIA score. This score of min 40% is also required to become eligible for attending SEE.  Semester-End Examination (SEE): This component represents the summative assessment carried  out in the form of an examination conducted at the end of the semester. SEE will carry 50 marks, after due scaling. To pass SEE, a student score min 40% (in other words, 20 out of 50 in SEE).  Marks obtained in CIA and SEE components have equal weightage (CIA: 50 and SEE: 50) in  determining the final marks and grades obtained by a student in a Course. | | | |

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| **English LSRW** | | | |
| **Course Code:** | | **Maximum marks: 100** | |
| **L-P-E: 2-2-0** | **Total Credits: 3** | | **Total Contact Hours: 60** |
| **Semester: I** | | | |
| **Prerequisites (if any):** NA | | | |
| **Introduction:**  This course aims to develop the four pillars of English communication: Listening, Speaking, Reading and Writing. The course is designed to benchmark against the CEFR framework and is tailored to focus on enhancing English Language proficiency in daily activities. | | | |
| **Course Outcomes:** On completion of the course, students will be able to: | | | |
| |  |  |  | | --- | --- | --- | | **COs** | **Course outcomes** | **RBT** | | **CO1** | Demonstrate understanding of listening and speaking strategies, such as intonation and accent. | L2 | | **CO2** | Apply comprehension and analytical skills in going through reading comprehension texts. | L3 | | **CO3** | Apply grammatical rules and improve vocabulary usage in writing and speaking. | L3 | | **CO4** | Evaluate resumes and cover letters to determine their effectiveness - using the techniques taught in the course. | L5 | | **CO5** | Develop well-structured essays, reports, and other written documents. | L3 | | | | |
| **Syllabus** | | | |
| **Module-1 - 12 hours** | | | |
| **Listening and Speaking**  Introduction to listening and speaking skills, Understanding different accents and intonation, Developing active listening skills, Participating in discussions and debates, Giving presentations and speeches. | | | |
| **Module – 2 - 12 hours** | | | |
| **Reading**  Introduction to reading skills, Skimming and scanning for information, Identifying main ideas and supporting details, Understanding tone and purpose, Reading for inference and implication. | | | |
| **Module – 3 - 12 hours** | | | |
| **Writing**  Introduction to writing skills, Planning and organizing written work, Writing effective emails and memos, Writing reports and proposals, Writing for specific audiences and purposes. | | | |
| **Module-4 - 12 hours** | | | |
| **Grammar and Vocabulary**  Introduction to grammar and vocabulary, Understanding verb tenses and structures, Practicing correct sentence formation, Building vocabulary through context and word roots, Using idioms and phrasal verbs in communication. | | | |
| **Module-5 - 12 hours** | | | |
| **Business and Technical Communication**  Introduction to business and technical communication, Writing effective resumes and cover letters, Conducting effective interviews, Understanding and writing technical documents, Communicating with clients and colleagues in professional settings. | | | |
| **Textbooks:**   * Professional English: for AKTU, Meenakshi R Raman and Sangeetha Sharma, Oxford Publication 1st edition   **Reference Books:**   * Word Power Made Easy; Norman Lewis; Penguin Random House India; Latest edition 2015   **Course Assessment:**  There shall be two components of grading in the assessment of each course:  CIA- Continuous Internal Assessments  SEE- Semester End Exam  CIA: - The CIA is conducted during the semester at regular intervals. This component  represents the formative assessment of students' learning. At an aggregate, CIA will carry 50 marks, after due scaling. To pass the CIA, a student must score min 40% (in other words, 20 out of 50 in CIA) in the aggregate CIA score. This score of min 40% is also required to become eligible for attending SEE.  Semester-End Examination (SEE): This component represents the summative assessment carried  out in the form of an examination conducted at the end of the semester. SEE will carry 50 marks, after due scaling. To pass SEE, a student score min 40% (in other words, 20 out of 50 in SEE).  Marks obtained in CIA and SEE components have equal weightage (CIA: 50 and SEE: 50) in  determining the final marks and grades obtained by a student in a Course. | | | |

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| **Constitution of India** | | | |
| **Course Code:** | | **Maximum marks : 50** | |
| **L-P-E: 2-0-0** | **Total Credits: 2** | | **Total Contact Hours: 30** |
| **Semester: I** | | | |
| **Prerequisites (if any):** NA | | | |
| **Introduction:**  This course provides a comprehensive understanding of the Constitution of India. It covers the historical background, the Preamble, fundamental rights and duties, the structure and functions of the executive, legislature, and judiciary, as well as the processes of amendment and the federal structure. Students will gain insights into the legal and political framework that governs the country and its impact on society. | | | |
| **Course Outcomes:** On completion of the course, students will be able to: | | | |
| |  |  |  | | --- | --- | --- | | **COs** | **Course outcomes** | **RBT** | | **CO1** | Outline the historical background and development of the Indian Constitution. | L2 | | **CO2** | Illustrate fundamental rights, duties, and directive principles enshrined in the Constitution. | L2 | | **CO3** | Explain the structure and functions of the executive, legislature, and judiciary in India. | L2 | | **CO4** | Analyse the federal structure and the distribution of powers between the Union and the States. | L4 | | **CO5** | List the process and significance of constitutional amendments. | L4 | | | | |
| **Syllabus** | | | |
| **Module-1 - 6 hours** | | | |
| **Introduction to the Constitution of India**  Historical background, Making of the Constitution, Preamble and its significance, Basic structure doctrine. | | | |
| **Module – 2 - 6 hours** | | | |
| **Fundamental Rights and Duties**  Fundamental rights, Fundamental duties, Directive principles of state policy, Case studies on landmark judgments | | | |
| **Module – 3 - 6 hours** | | | |
| **Structure and Functions of the Executive, Legislature, and Judiciary**  The President and Vice-President, Parliament, State Legislature, The Prime Minister and Council of Ministers, The Judiciary - Supreme Court, High Courts, Subordinate Courts | | | |
| **Module-4 - 6 hours** | | | |
| **Federal Structure and Distribution of Powers**  Federalism in India, Division of powers: Union, State, and Concurrent lists, Inter-state relations, Emergency provisions | | | |
| **Module-5 - 6 hours** | | | |
| **Constitutional Amendments and Their Impact**  Process of amendment, Significant amendments and their implications, Judicial review and interpretation, Role of the Constitution in shaping Indian governance | | | |
| **Textbooks:**   * "Introduction to the Constitution of India" by Durga Das Basu, LexisNexis, 23rd Edition, 2018. * "Indian Polity" by M. Laxmikanth, McGraw Hill Education, 6th Edition, 2020.   **Reference Books:**   * "The Constitution of India: A Contextual Analysis" by Arun K. Thiruvengadam, Bloomsbury Professional, 1st Edition, 2017. * "Granville Austin: The Indian Constitution - Cornerstone of a Nation" by Granville Austin, Oxford University Press, 2000.   **Course Assessment:**  This course will be fully graded basis CIA (Continuous Internal Assessment). It is conducted during the semester at regular intervals. This component represents the formative assessment of students' learning.  Therefore, 100% of the grading is done basis CIA. The minimum passing marks required is 40% of the total CIA. | | | |

# **Semester 2**

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| **Critical Thinking** | | | |
| **Course Code:** | | **Maximum marks: 50** | |
| **L-P-E: 2-0-0** | **Total Credits: 2** | | **Total Contact Hours: 30** |
| **Semester: II** | | | |
| **Prerequisites (if any): NA** | | | |
| **Introduction:**  Critical Thinking is a course designed to introduce students to the concepts of reasoning and decision-making, and to the cognitive biases and heuristics that can impede accurate and rational thinking. Based on the seminal book "Thinking, Fast and Slow" by Daniel Kahneman, the course will equip students with the skills to recognise and avoid common thinking errors, and to think more critically and effectively. | | | |
| **Course Outcomes:** On completion of the course, students will be able to: | | | |
| |  |  |  | | --- | --- | --- | | **COs** | **Course outcomes** | **RBT** | | **CO1** | Demonstrate the cognitive biases and heuristics that can affect human reasoning. | L2 | | **CO2** | Identify common thinking errors and fallacies in everyday situations. | L3 | | **CO3** | Apply critical thinking skills to analyse and classify arguments and evidence. | L3 | | **CO4** | Develop ideas and perspectives from different sources to develop reasoned and well-supported arguments. | L3 | | **CO5** | Evaluate the reliability and validity of different sources of information and evidence. | L4 | | | | |
| **Syllabus** | | | |
| **Module-1 - 10 hours** | | | |
| **The two systems of thinking**  Why think critically, The two systems of thinking, The mental power unit, The lazy system, The marvels of priming, Cognitive ease, Norms, surprises and ease, How judgements work, Jumping to conclusions | | | |
| **Module – 2 - 10 hours** | | | |
| **Heuristics and biases**  The law of small numbers, Anchoring effect, Availability bias, Representativeness bias, Conjunction fallacy, Survivorship bias, Sunk cost fallacy, Confirmation bias, Google effect and other common biases | | | |
| **Module – 3 - 10 hours** | | | |
| **Critical thinking in action**  Assignments on identifying biases in the news, creating fake news, writing an unbiased review, alien travel guide, facts vs opinion, worst case scenarios, hypothetical scenarios | | | |
| **Textbooks:**   * Thinking, Fast and Slow; Daniel Kahneman; Penguin 2012 edition   **Reference Books:**   * Critical Thinking; Jonathan Haber; The MIT Press; Illustrated edition (7 April 2020)   **Course Assessment:**  This course will be fully graded basis CIA (Continuous Internal Assessment). It is conducted during the semester at regular intervals. This component represents the formative assessment of students' learning.  Therefore, 100% of the grading is done basis CIA. The minimum passing marks required is 40% of the total CIA. | | | |

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| **Basics of Engineering** | | | |
| **Course Code:** | | **Maximum marks: 100** | |
| **L-P-E: 3-0-0** | **Total Credits: 3** | | **Total Contact Hours: 45** |
| **Semester: II** | | | |
| **Prerequisites (if any):** NA | | | |
| **Introduction:**  This course focuses on helping students understand the basics of Engineering sciences. Following this, the students get a unique opportunity to build a modern computer system from scratch. Starting with NAND gate, the students build their way up to a fully functioning computer with an operating system, and gain a deep understanding of how computers work. | | | |
| **Course Outcomes:** On completion of the course, students will be able to: | | | |
| |  |  |  | | --- | --- | --- | | **COs** | **Course outcomes** | **RBT** | | **CO1** | Demonstrate understanding of basic electrical and electronics engineering | L2 | | **CO2** | Explain basic concepts of computer architecture principles. | L2 | | **CO3** | Apply Boolean algebra and logic design to predict outputs of logic gates. | L3 | | **CO4** | Make use of combinational and sequential circuits. | L3 | | **CO5** | Construct assembly language programs to control hardware components. | L3 | | **CO6** | Build a functional computer system using the concept of HACK architecture. | L3 | | | | |
| **Syllabus** | | | |
| **Module-1 - 11 hours** | | | |
| **Basics of Electrical and Electronics Engineering:**  Basic electrical concepts, Ohm's law, Kirchhoff's laws, AC and DC circuits, Basic instrumentation, Introduction to semiconductors, Diodes and their applications, Digital electronics fundamentals. | | | |
| **Module – 2 - 11 hours** | | | |
| **Boolean Logic and Digital Design:**  Introduction to digital systems and digital logic, Boolean algebra and logic gates, Combinational logic circuits, Sequential logic circuits, building elementary logic gates using Nand gates | | | |
| **Module – 3 - 11 hours** | | | |
| **Boolean Arithmetic and the CPU:**  Arithmetic logic unit (ALU), Half adder and full adder, Ripple carry adder, multi-bit addition, Multi-bit ALU, CPU components (registers, instruction memory, data memory), Microprocessors | | | |
| **Module-4 - 12 hours** | | | |
| **Memory and Machine Language:**  Random-access memory (RAM), Memory maps, Machine language, Assembly language, The HACK computer architecture, Implementation of a simple computer using the HACK architecture | | | |
| **Textbooks:**   * "Basic Electrical Engineering"; D.P. Kothari and I.J. Nagrath; McGraw Hill Education India   **Reference Books:**   * "Basic Electronics: Solid State"; B.L. Theraja; S. Chand & Company Ltd.   **Course Assessment:**  There shall be two components of grading in the assessment of each course:  CIA- Continuous Internal Assessments  SEE- Semester End Exam  CIA: - The CIA is conducted during the semester at regular intervals. This component  represents the formative assessment of students' learning. At an aggregate, CIA will carry 50 marks, after due scaling. To pass the CIA, a student must score min 40% (in other words, 20 out of 50 in CIA) in the aggregate CIA score. This score of min 40% is also required to become eligible for attending SEE.  Semester-End Examination (SEE): This component represents the summative assessment carried  out in the form of an examination conducted at the end of the semester. SEE will carry 50 marks, after due scaling. To pass SEE, a student score min 40% (in other words, 20 out of 50 in SEE).  Marks obtained in CIA and SEE components have equal weightage (CIA: 50 and SEE: 50) in  determining the final marks and grades obtained by a student in a Course. | | | |

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| **Problem Solving using Programming - 2** | | | |
| **Course Code:** | | **Maximum marks: 100** | |
| **L-P-E: 1-6-0** | **Total Credits: 4** | | **Total Contact Hours: 105** |
| **Semester: II** | | | |
| **Prerequisites (if any):** Problem Solving using Programming - 1 | | | |
| **Introduction:**  Problem Solving using Programming - 2 builds on its predecessor course in teaching students deeper concepts in Programming. This course is taught in C++ and Python. This focuses on concepts such as Advanced Control Structures, Modularity, Nested Looping etc. . | | | |
| **Course Outcomes:** On completion of the course, students will be able to: | | | |
| |  |  |  | | --- | --- | --- | | **COs** | **Course outcomes** | **RBT** | | **CO1** | Explain programming concepts, including how functions, nested conditional and nested looping statements work. | L2 | | **CO2** | Apply programming constructs to solve problems and algorithms in C++ and Python. | L3 | | **CO3** | Compare different control statements in order to choose the right construct for different problems. | L4 | | **CO4** | Discover programming constructs to develop larger programs that solve complex problems. | L4 | | **CO5** | Evaluate the strengths and weaknesses of different programming constructs and choose appropriate solutions for different problems | L5 | | **CO6** | Illustrate principles of modular programming and its benefits in software development. | L2 | | | | |
| **Syllabus** | | | |
| **Module-1 - 21 hours** | | | |
| **Control Structures Advanced:**  Nested if, Nested if, else if, Else, for loop, while loop in arrays and strings; Exception handling; using recursive functions to solve problems that can be broken down into smaller sub-problems | | | |
| **Module – 2 - 21 hours** | | | |
| **Loops Advanced:**  advanced techniques for using loops, such as using loop counters, loop flags, and sentinel values; using advanced branching techniques such as the ternary operator and conditional expressions | | | |
| **Module – 3 - 21 hours** | | | |
| **Modularity:**  Organising code into modules, classes, and functions to improve code structure and reusability; Function parameters; Function return value; reviewing recursion and its use in function design and implementation; Libraries and APIs. | | | |
| **Module-4 - 21 hours** | | | |
| **Introduction to Data Structures:**  Overview of data structures, Arrays and linked lists, Stacks and queues, Trees and graphs - basic concepts along with practice problems. | | | |
| **Module-5 - 21 hours** | | | |
| **Using Generative AI:**  Breaking down the problem to programming patterns, Prompt engineering for code, Prompt engineering for C and Python, use of AI agents in writing functionality. | | | |
| **Textbooks:**   * Think Like a Programmer: An Introduction to Creative Problem Solving by V. Anton Spraul, Released August 2012, published by No Starch Press   **Reference Books:**   * Programming in Python 3: A Complete Introduction to the Python Language; Mark Summerfield; Pearson Education; Second edition * C++ Programming Language; Bjarne Stroustrup; Pearson Education; 4th edition   **Course Assessment:**  There shall be two components of grading in the assessment of each course:  CIA- Continuous Internal Assessments  SEE- Semester End Exam  CIA: - The CIA is conducted during the semester at regular intervals. This component  represents the formative assessment of students' learning. At an aggregate, CIA will carry 50 marks, after due scaling. To pass the CIA, a student must score min 40% (in other words, 20 out of 50 in CIA) in the aggregate CIA score. This score of min 40% is also required to become eligible for attending SEE.  Semester-End Examination (SEE): This component represents the summative assessment carried  out in the form of an examination conducted at the end of the semester. SEE will carry 50 marks, after due scaling. To pass SEE, a student score min 40% (in other words, 20 out of 50 in SEE).  Marks obtained in CIA and SEE components have equal weightage (CIA: 50 and SEE: 50) in  determining the final marks and grades obtained by a student in a Course. | | | |

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| **Frontend Web Development Advanced** | | | |
| **Course Code:** | | **Maximum marks: 100** | |
| **L-P-E: 1-6-0** | **Total Credits: 4** | | **Total Contact Hours: 105** |
| **Semester: II** | | | |
| **Prerequisites (if any):** Frontend Web Development Basics | | | |
| **Introduction:**  This advanced course in Front-end Web Development takes a deep dive into modern JavaScript and React.js. Starting with intricate JavaScript concepts like prototypal inheritance, async programming, and unit testing, the course moves on to foundational and intermediate React skills, including hooks, state management, and component lifecycle. Finally, it offers an in-depth exploration of advanced React features like Redux, Material-UI, and API integration. This course is designed to equip developers with the skills necessary to build robust, scalable, and responsive web applications. | | | |
| **Course Outcomes:** On completion of the course, students will be able to: | | | |
| |  |  |  | | --- | --- | --- | | **COs** | **Course outcomes** | **RBT** | | **CO1** | Explain core concepts and advanced features of React. | L2 | | **CO2** | Develop complex user interfaces using React components and hooks. | L3 | | **CO3** | Evaluate performance of React applications using optimization techniques. | L5 | | **CO4** | Assess statement management solutions and their integration in React applications. | L4 | | **CO5** | Design an application using React concepts and robust architecture. | L6 | | **CO6** | Integrate React with various APIs and backend services for full-stack web development. | L6 | | | | |
| **Syllabus** | | | |
| **Module-1 - 21 hours** | | | |
| **Javascript Concepts:** JS Prototypal Inheritance, JS Async, JS Callbacks, JS Promises, JS APIs, JS Axios, Unit testing in JS, Deployment | | | |
| **Module – 2 - 21 hours** | | | |
| **React first steps:** Environment set up, Introduction to React, Props & State, Components, React App using Babel, Rendering lists of data | | | |
| **Module – 3 - 21 hours** | | | |
| **React Intermediate:** JSX, Hooks, Additional Hooks, Event Handling, Component Lifecycle, Class based components, Routing | | | |
| **Module-4 - 21 hours** | | | |
| **React deep dive:**  React Forms, Fetching Data from API, Redux, React Redux, Redux Toolkit, React CSS Library, Material-ui | | | |
| **Module-5 - 21 hours** | | | |
| **Integrating React with Backend Services:**  Fetching data with Axios and Fetch API, Handling asynchronous operations, Integrating GraphQL with React, Authentication and authorization in React applications, Real-time data with WebSockets | | | |
| **Textbooks:**   * Web development: This book includes: Web development for Beginners in HTML + Web design with CSS + Javascript basics for Beginners; Andy Vickler; Ladoo Publishing LLC (24 May 2021) * The Road to Learn React: Your Journey to Master Plain Yet Pragmatic React.Js; Robin Wieruch; Zaccheus Entertainment (1 January 2018)   **Reference Books:**   * HTML, CSS, and JavaScript All in One; Julie C. Meloni & Jennifer Kyrnin; Pearson Education; Third edition * React and React Native: A complete hands-on guide to modern web and mobile development with React.js; Adam Boduch & Roy Derks; Packt Publishing Limited; 3rd edition   **Course Assessment:**  There shall be two components of grading in the assessment of each course:  CIA- Continuous Internal Assessments  SEE- Semester End Exam  CIA: - The CIA is conducted during the semester at regular intervals. This component  represents the formative assessment of students' learning. At an aggregate, CIA will carry 50 marks, after due scaling. To pass the CIA, a student must score min 40% (in other words, 20 out of 50 in CIA) in the aggregate CIA score. This score of min 40% is also required to become eligible for attending SEE.  Semester-End Examination (SEE): This component represents the summative assessment carried  out in the form of an examination conducted at the end of the semester. SEE will carry 50 marks, after due scaling. To pass SEE, a student score min 40% (in other words, 20 out of 50 in SEE).  Marks obtained in CIA and SEE components have equal weightage (CIA: 50 and SEE: 50) in  determining the final marks and grades obtained by a student in a Course. | | | |

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| **Engineering Chemistry** | | | |
| **Course Code:** | | **Maximum marks: 100** | |
| **L-P-E: 3-0-0** | **Total Credits: 3** | | **Total Contact Hours: 45** |
| **Semester: II** | | | |
| **Prerequisites (if any): NA** | | | |
| **Introduction:**  Engineering Chemistry provides a comprehensive understanding of chemical principles and their applications in engineering. This course covers the basics of atomic structure and chemical reactions, dives into chemical thermodynamics and equilibrium, and explores the kinetics of chemical reactions. Students will learn about the rates of reactions, mechanisms, the impact of temperature, and the role of catalysts, including enzyme catalysis. This knowledge equips students with the ability to apply chemical concepts to solve engineering problems and innovate in various technological fields. | | | |
| **Course Outcomes:** On completion of the course, students will be able to: | | | |
| |  |  |  | | --- | --- | --- | | **COs** | **Course outcomes** | **RBT** | | **CO1** | Explain basic principles of Chemistry such as enthalpy, entropy and free energy. | L2 | | **CO2** | Examine how Chemistry is used to solve real-world problems. | L3 | | **CO3** | Apply principles of Chemistry to solve case studies involving topics like health, environmental impact and energy. | L3 | | **CO4** | Make use of Chemistry concepts to solve case studies involving Computer Science problems. | L3 | | **CO5** | Analyse the kinetics of chemical reactions to determine the factors influencing reaction rates and the mechanisms involved | L4 | | | | |
| **Syllabus** | | | |
| **Module-1 - 9 hours** | | | |
| **Basic Principles:**  Atomic structure: electrons, protons, neutrons, periodic table; Chemical reactions: stoichiometry, acids and bases, oxidation and reduction | | | |
| **Module – 2 - 9 hours** | | | |
| **Chemical Thermodynamics:**  Gibbs free energy, enthalpy, entropy, free energy | | | |
| **Module – 3 - 9 hours** | | | |
| **Chemical Equilibrium:**  Introduction to chemical equilibrium, Le Châtelier’s Principle, Solubility and Acid-Base Equilibrium. | | | |
| **Module-4 - 9 hours** | | | |
| **Chemical Kinetics 1:**  Rates of chemical reactions, rate expressions and rate laws, radioactive decay, second order integrated rate laws, elementary steps and molecularity. | | | |
| **Module-5 - 9 hours** | | | |
| **Chemical Kinetics 2:**  Investigating reaction mechanisms, effect of temperature on reaction rates, the reaction coordinate and the activation complex, introduction to catalysis, types of catalysts, catalysts of life and enzyme catalysis | | | |
| **Textbooks:**   * Principles of Science by Donald E. Simanek and John R. Erickson (Pearson Education India, 2019) * The Sciences: An Integrated Approach by James Trefil and Robert M. Hazen (published by John Wiley & Sons, latest edition) * MIT OCW: Principles Of Chemical Science   **Reference Books:**   * Science Matters: Achieving Scientific Literacy by Robert M. Hazen and James Trefil (Penguin Random House India, 2017) * Science and Technology in World History: An Introduction by James E. McClellan III and Harold Dorn (Johns Hopkins University Press, 2018) * Physics for Scientists and Engineers by Randall D. Knight (published by Pearson, latest edition) * Chemistry: The Central Science by Theodore E. Brown, H. Eugene LeMay, Bruce E. Bursten, Catherine J. Murphy, and Patrick M. Woodward (published by Pearson, latest edition)   **Course Assessment:**  There shall be two components of grading in the assessment of each course:  CIA- Continuous Internal Assessments  SEE- Semester End Exam  CIA: - The CIA is conducted during the semester at regular intervals. This component  represents the formative assessment of students' learning. At an aggregate, CIA will carry 50 marks, after due scaling. To pass the CIA, a student must score min 40% (in other words, 20 out of 50 in CIA) in the aggregate CIA score. This score of min 40% is also required to become eligible for attending SEE.  Semester-End Examination (SEE): This component represents the summative assessment carried  out in the form of an examination conducted at the end of the semester. SEE will carry 50 marks, after due scaling. To pass SEE, a student score min 40% (in other words, 20 out of 50 in SEE).  Marks obtained in CIA and SEE components have equal weightage (CIA: 50 and SEE: 50) in  determining the final marks and grades obtained by a student in a Course. | | | |

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| **English for Professionals** | | | |
| **Course Code:** | | **Maximum marks: 100** | |
| **L-P-E: 2-2-0** | **Total Credits: 3** | | **Total Contact Hours: 60** |
| **Semester: II** | | | |
| **Prerequisites (if any):** English LSRW | | | |
| **Introduction:**  This course aims to develop upon the previous English LSRW. The course is designed to benchmark against the CEFR framework and is tailored to enhance English Language proficiency for professional activities. | | | |
| **Course Outcomes:** On completion of the course, students will be able to: | | | |
| |  |  |  | | --- | --- | --- | | **COs** | **Course outcomes** | **RBT** | | **CO1** | Demonstrate understanding of key concepts in business writing - such as clarity, conciseness and coherence. | L2 | | **CO2** | Develop engaging and well-structured presentations. | L3 | | **CO3** | Apply business etiquette concepts taught in the course in professional situations. | L3 | | **CO4** | Create effective emails, reports and proposals for business correspondence. | L6 | | **CO5** | Analyse various professional communication scenarios to identify their effectiveness. | L4 | | | | |
| **Syllabus** | | | |
| **Module-1 - 15 hours** | | | |
| **Business Writing Fundamentals:**  Business writing fundamentals (emails, reports, proposals), Effective writing techniques (clarity, conciseness, coherence), Proofreading and editing skills | | | |
| **Module – 2 - 15 hours** | | | |
| **Business Presentation Skills:**  Business Presentation Skills, Strategies for effective listening and responding, Techniques for leading and participating in meetings, Negotiation and conflict resolution skills | | | |
| **Module – 3 - 15 hours** | | | |
| **Business Etiquette and Protocol:**  Business etiquette and protocol, Networking and professional relationships, Intercultural communication and diversity, Teamwork and collaboration skills | | | |
| **Module-4 - 15 hours** | | | |
| **Case Studies and Role-playing Exercises:**  Case studies and role-playing exercises, Analysing and responding to professional communication challenges, Developing communication strategies for specific situations | | | |
| **Textbooks:**   * Bovée, C. L., & Thill, J. V. (2021). Business communication today (15th ed.). Pearson. * Guffey, M. E., & Loewy, D. (2021). Essentials of business communication (11th ed.). Cengage Learning. * Munter, M., & Hamilton, L. (2021). Guide to managerial communication (11th ed.). Pearson. * Hynes, G. E. (2018). Managerial communication: Strategies and applications (7th ed.). SAGE Publications.   **Reference Books:**   * Amartya Sen, The Argumentative Indian (1st ed.). Penguin UK   **Course Assessment:**  There shall be two components of grading in the assessment of each course:  CIA- Continuous Internal Assessments  SEE- Semester End Exam  CIA: - The CIA is conducted during the semester at regular intervals. This component  represents the formative assessment of students' learning. At an aggregate, CIA will carry 50 marks, after due scaling. To pass the CIA, a student must score min 40% (in other words, 20 out of 50 in CIA) in the aggregate CIA score. This score of min 40% is also required to become eligible for attending SEE.  Semester-End Examination (SEE): This component represents the summative assessment carried  out in the form of an examination conducted at the end of the semester. SEE will carry 50 marks, after due scaling. To pass SEE, a student score min 40% (in other words, 20 out of 50 in SEE).  Marks obtained in CIA and SEE components have equal weightage (CIA: 50 and SEE: 50) in  determining the final marks and grades obtained by a student in a Course. | | | |