<table>
<thead>
<tr>
<th>Subject Code/Name</th>
<th>Course Outcomes</th>
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</thead>
<tbody>
<tr>
<td>U18MH101 ENGINEERING MATHEMATICS-I</td>
<td>After completion of this course, the students will be able to,</td>
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<tr>
<td>CO1: test the convergence/divergence of a given series and understand the basic concepts of limit, continuity, differentiability of a function, and will be able to expand a given function in series.</td>
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<tr>
<td>CO2: apply the technique of differentiation under integral sign to solve an integral and find maxima &amp; minima of functions of two/several variables.</td>
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<tr>
<td>CO3: solve a given differential equations of first order with boundary conditions and understand the application of differential equations of first order.</td>
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<tr>
<td>CO4: solve a given higher order linear differential equation with constant coefficients and Understand few engineering applications.</td>
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<tr>
<td>U18CS102 PROGRAMMING FOR PROBLEM SOLVING USING C</td>
<td>CO1: draw the block diagram of a computer, enumerate programming development steps, design an algorithm and flow chart for a given application</td>
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<tr>
<td>CO2: apply logical skills for problem solving using control structures and arrays</td>
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<td>CO3: develop string programs and modular programming with functions</td>
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<tr>
<td>CO4: implement structures, unions, pointers and files in C programming</td>
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<tr>
<td>U18PH103/U18PH203 ENGINEERING PHYSICS</td>
<td>CO1: determine the time period and frequency of SHM oscillatory system and know the principles and applications of ultrasonics in different fields</td>
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<tr>
<td>CO2: analyse and apply the concepts of interference, diffraction and polarization phenomena in accurate determination of wavelengths, thicknesses, narrow slit widths, optical activity, etc</td>
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<tr>
<td>CO3: describe the characteristics and working of lasers, optical fibers and their applications in various fields</td>
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<tr>
<td>CO4: classify and enumerate the properties of magnetic, superconducting and nano materials and know their engineering applications</td>
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<tr>
<td>U18MH104/U18MH204 ENGLISH FOR COMMUNICATION</td>
<td>CO1: acquire grammar awareness and use error-free language in speech and writing</td>
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<tr>
<td>CO2: use appropriate vocabulary to describe various situations</td>
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<tr>
<td>CO3: implement a particular reading strategy to comprehend the text</td>
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<tr>
<td>CO4: communicate impressively and effectively</td>
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<tr>
<td>U18ME104/U18ME204 ENGINEERING</td>
<td>After completion of the course, the student will be able to,</td>
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<tr>
<td>CO1: draw projections of points and straight lines-I.</td>
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**B. Tech - I-Year II-Semester**

<table>
<thead>
<tr>
<th>Subject Code/Name</th>
<th>Co’s</th>
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</table>
| U18EE105 / U18EE205 BASIC ELECTRICAL ENGINEERING | CO1: determine voltage, current & power in electrical circuits using mesh & nodal analysis  
CO2: apply suitable DC network theorems to analyze T & π networks  
CO3: find current, voltage & power in 1-φ & 3-φ AC circuits  
CO4: explain construction, working principle & applications of electrical machines; electrical earthing, fuses, lighting sources, MCB & batteries |
| U18CE105 / U18CE205 ENGINEERING MECHANICS | CO1: understand the physical action of forces on the bodies through free body diagrams and analyse the forces using principles of force  
CO2: determine the axial forces in members of pin jointed structures subjected to various types of loadings  
CO3: understand the technical importance of geometrical shapes using centroid and moment of inertia concepts  
CO4: understand equilibrium condition of particles in dynamic condition and can analyse the problems using various applications such as impulse-momentum principle and work energy |
| U18CS107 PROGRAMMING FOR PROBLEM SOLVING USING C LAB | CO1: handle basic electrical equipments  
CO2: understand the concepts of network elements and theorems  
CO3: understand fundamental concepts of 1-phase and 3-phase AC circuits  
CO4: determine illumination of various lighting sources |
| U18MH201 ENGINEERING MATHEMATICS- II | CO1: compute inverse of a matrix using elementary transformations, compute rank of a matrix, and to solve a system of linear algebraic equations, to compute characteristic values, characteristic vectors of a given square matrix and reduce a given quadratic form to canonical form  
CO2: find double integral and triple integral and apply them to find moment of inertia, centre of gravity of plane lamina ; understand Beta and Gama functions and their relations and evaluate an improper integral in terms of Beta and Gamma functions  
CO3: understand the concept of a vector function and vector differentiation and will be able to find the characteristics of a space curve such as tangent, normal, binormal, curvature and torsion ; understand the concept of gradient , divergence and curl of a vector point function and will be able to apply them to find angle between two surfaces, and scalar potential  
CO4: find line, surface and volume integrals of vector valued functions and understand Green’s theorem, Stokes theorem and Gauss theorem. |
| U18CS202 DATA STRUCTURES THROUGH C | CO1: implement programs using static & dynamic arrays  
CO2: apply the linear data structures with stacks and queues  
CO3: arrange the data with the help of various sorting techniques and linked lists  
CO4: organize the data using non-linear data structures with trees and graphs |
| U18EE106 / U18EE206 BASIC ELECTRICAL | After completion of the course, the students will be able to  
CO1: handle basic electrical equipments |
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<thead>
<tr>
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</thead>
</table>
| U18PH108/U18PH208  | ENGINEERING PHYSICS LABORATORY | CO1: measure precisely the values of elastic properties, moments of inertia, acceleration due to gravity, etc  
CO2: make precise measurements of wavelengths, diameter of thin wires, limit of resolution and optical rotation from light phenomena (Interference, diffraction and polarization)  
CO3: measure wavelengths, slit widths from diffraction patterns using laser light  
CO4: measure numerical aperture, acceptance angle and fiber losses of optical fibers |
| U18CH108/U18CH208  | ENGINEERING CHEMISTRY LABORATORY | CO1: determine water quality parameters - alkalinity, hardness  
CO2: estimate metals from their ores  
CO3: handle analytical instruments for chemical analysis  
CO4: measure saponification / acid value of an oil |
| U18CS207  | DATA STRUCTURES THROUGH C LABORATORY | CO1: implement the fundamental data structures using C-language  
CO2: develop programs using linear data structures (stacks, queues)  
CO3: develop programs arranging the data using various sorting techniques  
CO4: develop program using linked representation |
| U18ME109/U18ME209  | WORKSHOP PRACTICE | CO1: prepare various joints in carpentry trade  
CO2: prepare a mould cavity using single and two piece pattern  
CO3: perform various joints in fitting and plumbing trade  
CO4: weld metals using arc welding, gas welding and soldering |
| U18CH109/U18CH209  | ENVIRONMENTAL STUDIES | CO1: investigate any environmental issue using an interdisciplinary framework  
CO2: formulate an action plan for sustainable alternatives and conserving biodiversity that integrates science, humanist, social and economic perspective  
CO3: identify and explain the complexity of issues and processes which contribute to an environmental problem  
CO4: participate effectively in analysis and problem-solving through knowledge in environmental legislations |
| U18EA110/U18EA210  | EAA: SPORTS/YOGA/NSS | CO1: develop his/her personally through community service rendered  
CO2: apply their education to find solutions to individual and community problems  
CO3: acquire capacity to meet emergencies and natural disasters  
CO4: acquire a democratic attitude, leadership qualities and practice national integration |
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<tr>
<td>U18MH301</td>
<td>CO 1: find the Laplace transform of a given function and apply Laplace transforms to solve and certain differential equations whose solutions cannot be computed using classical methods. CO2: describe a given function as Fourier series in an interval and understand its importance in engineering. CO3: understand the concept of a function of complex variable and verify whether a function is analytic or not, construct analytic function when real/imaginary part of the function is known; find velocity potential and stream function of a fluid flow using complex analytical methods. CO4: represent a given function in Taylor’s and Laurent’s series and evaluate certain real integrals using integral theorems.</td>
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<tr>
<td>U18MH302</td>
<td>CO1: Different types of questions related to reading comprehension CO2: identify grammatical errors in the given sentences and correct them CO3: select correct synonyms/antonyms/phrasal verbs and complete sentences with suitable words or phrases CO4: keep the given jumbled sentences in proper sequence to make a coherent paragraph</td>
</tr>
<tr>
<td>U18CS303</td>
<td>CO1: distinguish various programming paradigms and implement java fundamental programs. CO2: implement classes, constructors, and strings. CO3: apply reusability concepts like inheritance, dynamic method dispatch, and interfaces. CO4: implement packages, apply streams (I/O), exception handling, and multithreading.</td>
</tr>
<tr>
<td>U18MH304</td>
<td>CO1: explain the basic concepts of sets and relations and their applications to lattice problems, to determine all the possible paths available in directed paths CO2: analyze the different types of logic in order to establish knowledge based systems, to CO3: solve different type of enumeration problemsand apply to real life problems. CO4: solve different problems like Koenig’s Berge seven bridges, using Euler graphs and find the chromatic number of the different graphs.</td>
</tr>
<tr>
<td>U18CS305</td>
<td>CO1: identify functional units of a computer, explain addressing modes and instruction formats. CO2: write control sequence for execution of an instruction, explain hardwired and microprogrammed control and perform arithmetic operations with signed and unsigned integers. CO3: design memory organization and explain data transfer among memory, processor &amp; I/O. CO4: analyze different modes of data transfer and explain the concepts of parallel processing, pipelining for high performance computing systems.</td>
</tr>
<tr>
<td>U18CS306</td>
<td>CO1: implement programs using circular single linked list and double linked list. CO2: represent the data with non linear data structure using binary trees, binary search trees and AVL trees.</td>
</tr>
</tbody>
</table>
| U18EI309 DIGITAL ELECTRONICS | **CO1**: apply various minimization techniques to obtain minimal SOP/POS forms of switching functions  
| **CO2**: design different combinational circuits to implement logic functions  
| **CO3**: explain the operation of flip flops and design sequential circuits like counters, shift registers  
| **CO4**: minimize completely and incompletely specified state machines using partition and merger graph/table methods |
| U18CS310 OBJECT ORIENTED PROGRAMMING THROUGH JAVA LABORATORY | **CO1**: implement Java fundamental programs.  
| **CO2**: implement classes, constructors, and strings.  
| **CO3**: apply reusability concepts like inheritance, dynamic method dispatch, and interfaces.  
| **CO4**: implement packages, apply streams (I/O), exception handling, and multithreading. |
| U18CS311 ADVANCED DATA STRUCTURES LABORATORY | **CO1**: implement Multistack and different linked lists.  
| **CO2**: perform operations on binary search trees and AVL trees.  
| **CO3**: implement various operations on B-trees and graph traversal techniques.  
| **CO4**: apply the different methods on graph traversal, searching and sorting. |
| U18MH315 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE | **CO1**: summarize the basic structure of Vedas, Upavedas, Vedanga, Upanga  
| **CO2**: explain Vedas as principal source of knowledge for scientific inventions  
| **CO3**: describe different yogasanas, breathing techniques, chakras, meditation and their benefits  
| **CO4**: discuss the benefits of yoga as an effective tool for management of human crisis |
| U18OE401A APPLICABLE MATHEMATICS | **CO1**: solve wave equation, heat conduction equation and Laplace equation using Fourier series  
| **CO2**: find correlation regression coefficients, fit curves using method of least squares for given data and apply theoretical probability distributions in decision making  
| **CO3**: estimate value of a function by applying interpolation formulae  
| **CO4**: apply numerical methods to solve simultaneous algebraic equations, differential equations, find roots of algebraic and transcendental equations |
| U18OE401B BASIC ELECTRONICS ENGINEERING | **CO1**: Analyze the behavior of semiconductor devices  
| **CO2**: Design half wave and full wave rectifier circuits with filters  
| **CO3**: Characterize BJT configurations with input output characteristics and biasing techniques  
| **CO4**: Acquire knowledge of new emerging areas of science and technology in differentiating semiconductor devices. |
| U18OE401C ELEMENTS OF MECHANICAL ENGINEERING | **CO1**: explain mechanical properties of an engineering materials and learn the steps in design methodology.  
| **CO2**: describe the principles of manufacturing processes  
| **CO3**: apply first law of thermodynamics to various processes to calculate work and heat for a closed system.  
<p>| <strong>CO4</strong>: define second law of thermodynamics and demonstrate the working principle of IC engines. |
| U18OE401D | <strong>CO1</strong>: explain about working principle of measurement system, PMMC based meters and applications of DC &amp; AC bridge circuits |</p>
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| U18OE401E   | Fundamentals of Measurements & Instrumentation | CO2: describe the principle of operation of Q-meter, DVM, DMM, CRO, DSO and display devices  
CO3: elaborate on the working principle of resistive, inductive, capacitive and piezoelectric transducers and their applications  
CO4: explain about seismic transducers, sound level meter, level transducer, flow meters and block diagram of data acquisition system |
| U18OE401E   | Fundamentals of Computer Networks | CO1: describe various network topologies, architecture and techniques for data transmission modes  
CO2: outline various design issues in data link layer and develop protocols to handle data link layer operation  
CO3: describe various design issues and develop protocols for network Layer.  
CO4: explain various design issues, protocols of transport layer & application layer services |
| U18OE401F   | Renewable Energy Sources | CO1: compare conventional and non-conventional energy resources; explain the working principle of solar energy harnessing and its applications  
CO2: explain the working principles of wind energy, geothermal energy and MHD power generation systems  
CO3: describe the harnessing of electric power from oceans and biomass  
CO4: explain the principle of operation of fuel cells and different types of energy storage systems |
| U18TP402    | Soft Skills and Interpersonal Skills | CO1: introspect to convert strengths into opportunities, identify weaknesses, bypass threats  
CO2: present views on various issues confidently in a group  
CO3: make effective PPT presentations, synthesize videos  
CO4: prepare a professional resume, communicate effectively to attain better opportunities |
| U18OE403A   | Object Oriented Programming | CO1: demonstrate object oriented concepts and java programming features.  
CO2: solve computing problems using object orientation and inheritance concepts.  
CO3: use polymorphism, interfaces and Packages for effective object oriented programming  
CO4: handle Exceptions and I/O operations in application development. |
CO2: analyse fluid flows using Bernoulli’s equation and model laws.  
CO3: estimate losses in pipes and characterize hydraulic turbines.  
CO4: discuss the working principle and characteristics of pumps. |
| U18OE403C   | Mechatronics | CO1: apply the mechatronics approach ad select suitable sensors and transducers for a given application.  
CO2: explain working principles of mechanical, hydraulic, pneumatic and electrical actuators and their applications.  
CO3: develop basic building blocks for mechanical, electrical, fluid and thermal systems and build mathematical models and analyze.  
CO4: explain various system transfer functions and select an appropriate closed loop controller for a given application |
| U18OE403D   | Web Programming | CO1: create static web pages using HTML Tags, CSS properties and Java scripts  
CO2: create dynamic web pages using java server page concepts.  
CO3: develop web server side applications using PHP concepts  
CO4: develop enterprise databases for web-based applications using PHP and |
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<th>Code</th>
<th>Course Title</th>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>CO4</th>
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<tr>
<td>U18OE403E</td>
<td>MICROPROCESSORS</td>
<td>CO1: describe the architecture of 8086 microprocessor and explain instructions with suitable examples</td>
<td>CO2: write Assembly Language Programs (ALPs) to perform a given task</td>
<td>CO3: design 8086 microprocessor based system for given specifications with memory mapping</td>
<td>CO4: explain serial communication modes and discuss it standards</td>
</tr>
<tr>
<td>U18OE403F</td>
<td>STRENGTH OF MATERIALS</td>
<td>CO1: estimate various types of stresses and strains</td>
<td>CO2: construct Mohr’s circle, shear force and bending moment diagrams for determinate beams</td>
<td>CO3: determine the bending and shearing stresses for beams subjected to pure bending</td>
<td>CO4: analyze stresses in thin cylinders, circular shafts and springs by theory of pure torsion</td>
</tr>
<tr>
<td>U18CS404</td>
<td>THEORY OF COMPUTATION</td>
<td>CO1: write a formal notation for strings, languages and finite automata.</td>
<td>CO2: design context free grammars to generate strings of context free language.</td>
<td>CO3: determine equivalence of languages accepted by push down automata and languages generated by context free grammars.</td>
<td>CO4: distinguish between computability and non computability, decidability and undecidability in turing machines</td>
</tr>
<tr>
<td>U18CS405</td>
<td>DATABASE MANAGEMENT SYSTEMS</td>
<td>CO1: design the database management system effectively</td>
<td>CO2: design the databases, which includes Enhanced Entity Relationship model</td>
<td>CO3: outline the database by using normalization and query optimization techniques to avoid redundancy and maintain the performance of database.</td>
<td>CO4: manage multi-level security, correctness of data and control over access on database</td>
</tr>
<tr>
<td>U18CS406</td>
<td>OPERATING SYSTEMS</td>
<td>CO1: demonstrate the architecture of an operating system, process concepts and system calls</td>
<td>CO2: implement the CPU scheduling and process synchronization algorithms</td>
<td>CO3: solve the deadlock related problems and memory management issues</td>
<td>CO4: explain the file, disk and system protection techniques</td>
</tr>
<tr>
<td>U18CS407</td>
<td>DATABASE MANAGEMENT SYSTEMS LABORATORY</td>
<td>CO1: evaluate SQL queries using DDL/DML/TCL/DCL commands to create and manipulate data in database by enforcing constraints</td>
<td>CO2: demonstrate various database objects using SQL queries</td>
<td>CO3: implement block structured programming with cursors to enable traversal over the records of the database</td>
<td>CO4: implement pre-compiled stored programs, run-time errors checking, database objects collection in PL/SQL packages and high-level security using triggers</td>
</tr>
<tr>
<td>U18CS408</td>
<td>OPERATING SYSTEMS LABORATORY</td>
<td>CO1: recognize the importance of various categories of UNIX commands.</td>
<td>CO2: apply shell programming concepts for developing applications</td>
<td>CO3: implement different scheduling algorithms and compare their performance and apply the Banker’s algorithm for solving the dead lock avoidance problem.</td>
<td>CO4: implement different scheduling algorithms and compare their performance and apply the Banker’s algorithm for solving the dead lock avoidance problem.</td>
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<td>Course Code</td>
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| U18OE411A   | OBJECT ORIENTED PROGRAMMING LABORATORY           | **CO1:** implement OOP concepts using Java  
**CO2:** use the concepts like inheritance, polymorphism, packages and interfaces in application development  
**CO3:** handle runtime exceptions in object oriented programming  
**CO4:** build effective I/O interfaces for software applications |
| U18OE411B   | FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY| **CO1:** determine the hydraulic coefficient for various flow measuring devices  
**CO2:** apply Bernoulli’s equation in estimating head loss in pipes  
**CO3:** apply the principles of impact of jet on different vanes  
**CO4:** demonstrate the characteristics of hydraulic machines. |
| U18OE411C   | MECHATRONICS LAB                                 | **CO1:** Develop PLC program to control AC non servomotors, single acting and double acting pneumatic cylinders with different operation conditions  
**CO2:** Develop PLC program to control various systems.  
**CO3:** Integrate various mechanical and electrical systems and operate them.  
**CO4:** Design and simulate the hydraulic and pneumatic circuits. |
| U18OE411D   | WEB PROGRAMMING LAB                             | **CO1:** create the static web pages using HTML Tags and CSS and JavaScripts  
**CO2:** design dynamic web page for web applications using JSP  
**CO3:** develop server side scripts for web base applications using PHP  
**CO4:** design web applications for effective storage and retrieval of data in MySQL using PHP. |
| U18OE411E   | MICROPROCESSORS LAB                              | **CO1:** write and execute assembly language programs for given tasks on 8086 microprocessor kit  
**CO2:** implement code conversions and bit manipulations programs in 8086 using MASM  
**CO3:** write waveform generation code using DAC modules  
**CO4:** interface stepper motor, keyboard, memory etc. with 8086 microprocessor |
| U18OE411F   | STRENGTH OF MATERIALS LAB                       | **CO1:** correlate theory with the testing of engineering materials for quality assessment.  
**CO2:** evaluate the mechanical properties of civil engineering materials.  
**CO3:** appraise the behavior of civil engineering materials when tested under loads.  
**CO4:** realize the specifications recommended by codes to civil engineering materials. |
| U18CH416    | ENVIRONMENTAL STUDIES                           | **CO1:** investigate any environmental issue using an interdisciplinary framework  
**CO2:** formulate an action plan for sustainable alternatives and conserving biodiversity that integrates science, humanist, social and economic perspective  
**CO3:** identify and explain the complexity of issues and processes which contribute to an environmental problem  
**CO4:** participate effectively in analysis and problem-solving through knowledge in environmental legislations |

Head of the Department