

**R2019 – Courses and Course Outcomes**

Course Code	Course Name	Course Outcomes (to be read as “The student will be able to”)
Semester 1		
19FYM11	Calculus and Fourier series	<p>CO1: Assimilate ideas of limits and continuity, derive expression for derivatives using limit definition, understand the consequences of Rolle’s and mean value theorem on differentiable functions.</p> <p>CO2: Choose appropriate method to evaluate indefinite, definite and improper integrals.</p> <p>CO3: Compute partial derivatives of multivariable functions and determine maxima and minima of functions of two or three variables.</p> <p>CO4: Evaluate double and triple integrals and find the area of regions and volume of solids.</p> <p>CO5: Calculate both real and complex forms of Fourier series.</p>
19FYE11	Technical English	<p>CO1: Given a social context, compose appropriate dialogues using functional words, Construct Descriptive Paragraphs and reviews using sequencing words and unity of thought.</p> <p>CO2: Given a communication context, categorize the barriers to communication and formulate solutions. For a given communication situation, like introducing oneself, asking questions, disagreeing, expressing preferences, asking for and giving directions, generate functional expressions and construct dialogues.</p> <p>CO3: Given short conversations and monologues for listening, specify appropriate responses and construct a summary.</p> <p>CO4: Interpret the given technical graphical representation and compose passages. Summarize and paraphrase technical texts in about 250 to 300 words.</p> <p>CO5: Apply the rules of the grammar viz, word formation, verbs, tenses, question tags, prepositions, articles, conjunctions, concord, Idiomatic expressions, one-word substitutes, Homophones and homonyms, linking words, adjectives and Degrees of Comparison, use appropriate patterns in the given sentence.</p>
19FYP12	Applied Physics	<p>CO1: The students will be able to demonstrate basic knowledge about acoustics of buildings and ultrasonic waves</p> <p>CO2: The students will gain knowledge and understanding of lasers and optical fibers.</p> <p>CO3: The students will have a conceptual understanding of arrangement of atoms in crystals and acquire basic knowledge about nano materials.</p>
19FYC11	Engineering Chemistry	<p>CO1: Calculate the calorific value of different types of fuels and apply the same for suitable application.</p>

		<p>CO2: Be conversant with the principles and implication of corrosion and its application</p> <p>CO3: familiarize with various types of material analysis.</p> <p>CO4: Synthesize the nano materials of different size and shapes using different synthesis technique and apply the same for the energy conversion and storage devices.</p>
19ME11	Introduction to Mechanical Sciences	<p>CO1: Describe the concept of energy conversion and transmission with illustration</p> <p>CO2: Apply first law of thermodynamics to simple systems and arrive at benchmark performance indices for heat engines, refrigerators and heat pumps; and state second law of thermodynamics.</p> <p>CO3: Differentiate between various types of forces and their effects on matter</p> <p>CO4: Pictorially elucidate the major categories of manufacturing processes</p> <p>CO5: Explain operating principles of mechanical systems.</p>
19MEL11	Engineering Graphics	<p>CO1: Understand the importance of BIS and [SO Standards in Engineering Drafting.</p> <p>CO2: Imagine and visualize the geometric details of engineering objects.</p> <p>CO3: Communicate ideas through technical drawings.</p> <p>CO4: Use computer aided drafting in their respective engineering field.</p> <p>CO5: Interpret Orthographic and Isometric views of objects.</p>
19PL11	Physics Laboratory - I	<p>CO1: Gain a fundamental understanding of the apparatus used in the experiments and recognize how observation, experiment and theory work together.</p>
19CL11	Chemistry Laboratory - I	<p>CO1: appreciate how oxygen in water causes corrosion of boiler materials, by the estimation of dissolved oxygen present in water; handle analytical tools such as of conductometer and pH meter.</p> <p>CO2: gain an understanding of different types of volumetric titration.</p>
19FYEL11	Employability Skills	<p>CO1: Given strictly timed objective questions on logical reasoning and verbal ability solve within the given time.</p> <p>CO2: For a given specific speaking task on topics like describing a picture, movie reviews, and storytelling, generate ideas and speak confidently.</p> <p>CO3: For a given social situation viz., greeting, thanking, congratulating, apologizing and giving directions, demonstrate</p>

		<p>command over conversations using appropriate functional expressions.</p> <p>CO4: For a given 2 to 5 minutes speaking activity like Extempore and Debate, produce language structures accurately and fluently. For a given technical topic, prepare a power point presentation for 15 minutes.</p> <p>CO5: Given short conversations and monologues for listening, specify appropriate responses and construct a summary. Construct dialogues for a given social scenario and interpret the given graphic information and write creative paragraphs.</p>
Semester 2		
19FYM21	Matrices, Vector Calculus and Transforms	<p>CO1: Use computational techniques and algebraic skills in the study of eigen values and eigenvectors, diagonalization and quadratic forms</p> <p>CO2: Assimilate ideas of vector differentiation, evaluate line, surface and volume integrals and relate them using Green's, Gauss and Stoke's theorems.</p> <p>CO3: Solve initial and boundary value problems in ordinary differential equations and certain integral equations using Laplace transform</p> <p>CO4: Calculate Fourier transform and inverse transform of functions and use them in follow-up courses in engineering.</p> <p>CO5: Apply Z-transforms to solve difference equations.</p>
19FYP22	Physics for Mechanical Engineers	<p>CO1: Understand the vector representation of forces and moments and their transformations, principles of forces in mechanics and their relationship, work, momentum and energy related problems.</p> <p>CO2: Appraise the motion in non-inertial frames, uniformly accelerating frames and rotating frames of reference and their applications.</p> <p>CO3: Understand oscillatory motion such as simple harmonic, damped and forced oscillations.</p> <p>CO4: Analyse the dynamics of rigid bodies and its Rotation about an axis for engineering applications.</p>
19FYC21	Environmental Science and Engineering	<p>CO1: Gain insight into the chemical reactions in water, air and soil environment.</p> <p>CO2: Apply chemistry principles in analysing pollution of water, air and soil environment.</p> <p>CO3: Understand the fate of chemicals on the environment and suggest relevant interventions.</p> <p>CO4: Gain insight into the environmental protection act and the associated rules knowledge on the institutional setup for environmental management and pollution control.</p>
19EE21	Basic Electrical and Electronics Engineering	<p>CO1: Acquire knowledge about the working of induction machines, storage and display devices.</p> <p>CO2: Inculcate a foundation about the connectivity of various</p>

		<p>devices in communication networks and electrical installation.</p> <p>CO3: Realize the practical applications through case studies.</p>
19CSL11	C Programming Laboratory	<p>CO1: Write, compile and debug C programs.</p> <p>CO2: Develop simple programs using decision making statements and looping constructs.</p> <p>CO3: Practice operations on arrays, strings and pointer.</p> <p>CO4: Practice modularization of the given problem using functions.</p> <p>CO5: Write programs using structures and files.</p>
19PL21	Physics Laboratory – II	<p>CO1: Gain a fundamental understanding of the apparatus used in the experiments and recognize how observation, experiment and theory work together.</p>
19CL21	Chemistry Laboratory – II	<p>CO1: Understand how hardness producing salts create boiler troubles by performing EDTA titrations and quantify hardness producing ions present in raw water.</p> <p>CO2: Calculate rate of corrosion by the determination of weight loss method</p> <p>CO3: Handle analytical tools such as spectrophotometer, flame photometer, conductometer and potentiometer.</p>
19MEL12	Engineering Practices Laboratory	<p>CO1: Understand various engineering practices like carpentry, fitting, sheet metal, plumbing and electrical wiring and relevant tools.</p> <p>CO2: Identify and rectify minor electrical problems at home and office.</p> <p>CO3: Implement the skills acquired during their project work.</p> <p>CO4: Develop their hand-eye coordination capabilities.</p>
19FYEL21	English for Employability	<p>CO1: Given strictly timed objective questions on logical sequence of words, sequential order of things, comparison, and sentence correction, solve within the given time.</p> <p>CO2: For a given specific speaking task on topics like JAM, Describing an object, Book Review and Extempore, Generate ideas and speak confidently.</p> <p>CO3: For a given social situation viz., Travel and Transport, Complaining, Giving Instructions, Advising and Sympathizing, Requesting and Warning people, Communicate effectively to peer using appropriate functional language.</p> <p>CO4: For a given HR topic, generate valid points for and against the topic and present them with appropriate group behavior. For any job requirement, plan and prepare a 20 min HR mock interview.</p>
Semester 3		
19MEM31	Ordinary and Partial Differential Equations	<p>CO1: Analyze the concepts of ordinary differential equations in modelling and solving physical problems</p> <p>CO2: Formulate concrete problems and determine the solutions of partial differential equations</p> <p>CO 3: Solve the boundary value problems relevant to vibration of strings and heat equation</p> <p>CO 4: Demonstrate their understanding concept of Bessel's function and Legendre Polynomial, with its properties</p>

19ME31	Engineering Thermodynamics	<p>CO1: Apply concepts of energy conservation to open and closed systems.</p> <p>CO2: Arrive at benchmark performances of heat engines and refrigerator / heat pump and compute entropy changes.</p> <p>CO3: Depict various thermodynamic processes on property diagrams, estimate properties of mixtures and quantify deviation from ideal gas behavior.</p> <p>CO4: Calculate changes in properties during different ideal gas processes.</p>
19ME32	Engineering Mechanics for Mechanical Engineers	<p>CO1: Analyze the effect of forces on rigid bodies in equilibrium.</p> <p>CO2: Compute the first and second moment of inertia for simple and composite geometries.</p> <p>CO3: Apply concepts of energy conservation and virtual work to predict stability of equilibrium.</p> <p>CO4: Analyze translatory and rotary motions and examine the frictional and gyroscopic effects.</p> <p>CO5: Examine free and forced vibrations in damped and undamped systems.</p>
19ME33	Fluid Mechanics and Machinery	<p><i>CO1: Explain fluid properties, apply principles of manometry and analyze stability of floating bodies.</i></p> <p><i>CO2: Develop conservation equations of mass, momentum and energy for non-reactive fluid flows.</i></p> <p><i>CO3: Deduce Non-dimensional numbers using Buckingham's Pi theorem and explain similarity laws.</i></p> <p><i>CO 4: Analyze laminar boundary layer over a flat plate and distinguish between laminar and turbulent flows.</i></p> <p><i>CO5: Estimate head loss through pipes and explain velocity measurement using venturimeter, orifice meter and Pitot tubes.</i></p> <p><i>CO 6: Analyze turbines using velocity diagrams.</i></p>
19ME34	Embedded Processor Architecture and Programming	<p><i>CO1: Distinguish between RISC and CISC processors.</i></p> <p><i>CO2: Use the programmer's model and outline the architecture of the ARM processor.</i></p> <p><i>CO3: Choose the ARM instructions for performing data transfer, data processing and control operations.</i></p> <p><i>CO4: Develop assembly language programs for arithmetic and data acquisition applications.</i></p> <p><i>CO5: Write the assembly language program to control the speed of the dc motor and stepper motor.</i></p>
19HSS01	Science of Creativity and Professional Ethics	<p><i>CO1: Understand the principles of karma yoga, duty consciousness and evolution of the universe.</i></p> <p><i>CO2: Analyze the benefits of yoga and meditation.</i></p> <p><i>CO3: Understand the benefits of harmony, introspection and examine human values for sustained growth in career and life</i></p>
19MEL35	Computer Aided Machine Drawing – I	<p><i>CO1: Create drafting practices using basic commands to draw the component.</i></p> <p><i>CO2: Construct and edit models using commands (object controlling commands, hatching and blocks) in drafting.</i></p> <p><i>CO3: Specify text, use commands for geometric dimensioning</i></p>

		<p>and system variables for the mechanical drawing.</p> <p>CO4: Develop the orthographic projections of mechanical components.</p> <p>CO5: Create isometric drawings and use advanced drawing commands, script files and plotting commands for creation of mechanical components.</p>
19MEL36A	Fluid Mechanics and Machinery Laboratory	<p>CO1: Determine the coefficient of discharge of flow measurement devices - venturimeter, orifice meter, notches and mouthpiece using Bernoulli's equation.</p> <p>CO2: Experimentally estimate major and minor losses in pipelines.</p> <p>CO3: Prove Bernoulli's theorem experimentally.</p> <p>CO4: Experiment on centrifugal pump, reciprocating pump, jet pump and submersible pump to evaluate their performances.</p> <p>CO5: Experiment on Pelton wheel and Francis turbine to evaluate their performances.</p> <p>CO6: Summarize experimentation, analyze results and deduce conclusions. Synthesize reports of experiments in accordance with standards.</p>
19MEL36B	Electrical Machines & Drives	<p>CO1: Select a drive for a particular application based on power rating and characteristics of the application.</p> <p>CO2: Experimentally determine the braking characteristics of DC shunt motor and Induction motor.</p> <p>CO3: Demonstrate the converter topologies, inverter topologies control principles and modern tools used in DC drives, AC drives and special electric drives.</p> <p>CO4: Demonstrate the speed control of DC motors using converters and chopper fed drive and also to demonstrate the speed control of AC motors using inverter fed AC drive.</p> <p>CO5: Realize the drive based energy saving technique through experimental verification and to perform the speed control techniques for special electric machines using drive.</p>
	Embedded Systems Laboratory	<p>CO1: Develop simple programs for ARM Processor</p> <p>CO2: Analyze the input and output modules working through ARM development platform</p> <p>CO3: Experiment with display devices- LED &amp; LCD using ARM Processor</p> <p>CO4: Test the stepper motor setup for different step angle rotation using ARM processor</p> <p>CO5: Develop programs for interfacing various devices with ARM Processor</p>
19HOC31	Communication Skills for Engineers – I	<p>CO1: Gain confidence, enhance Personality and develop positive attitude in their work and life.</p> <p>CO2: Effectively communicate and present opinions using appropriate functional expressions for a given situation.</p> <p>CO3: Compose Emails, Reports for a given business scenario using appropriate sentence construction and in the prescribed format.</p> <p>CO4: Generate ideas and speak confidently on a given topic in a competitive scenario like Debate, Group Discussion, and Public Speaking.</p>

<b>Semester 4</b>		
19ME41	Applied Thermodynamics	<p>CO1: Determine thermodynamic state points in an Otto or Diesel cycle, using air-standard assumptions, to calculate the performance parameters of IC engines under specified operating conditions.</p> <p>CO2: (i) Compare the performance of single-stage and multi-stage compressors (isothermal compression) of specified clearance, with and without inter-cooling; (ii) Calculate the power requirements for a specified free air delivery and pressure ratio.</p> <p>CO3: Analyze the performance of ideal and non-ideal gas turbine cycles with one or more of the following modifications: regeneration, inter-cooling, and reheating, for specified operating conditions.</p> <p>CO4: (i) Analyze and compare the performance of an ideal and a non-ideal Rankine cycle and its modifications (regeneration, reheat, or a combination of reheat and regeneration) using steam tables or Mollier chart. (ii) Analyze steam flow through nozzles</p> <p>CO5: Use psychrometric chart or relations to estimate changes in enthalpy and humidity during sensible heating, cooling, humidification and dehumidification processes, for specified air-conditioning requirements.</p>
19ME42	Strength of Materials	<p>CO1: Recognize various types of loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components.</p> <p>CO2: Evaluate the strain and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.</p>
19ME43	Mechanics of Machines	<p>CO1: To understand the kinematics and rigid-body dynamics of kinematically driven machine components.</p> <p>CO2: To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link.</p> <p>CO3: To be able to design some linkage mechanisms and cam systems to generate specified output motion.</p> <p>CO4: To understand the kinematics of gear trains.</p>
19ME44	Materials Engineering	<p>At the end of this course, the students will be able to</p> <p>CO1: Identify crystal structures for various materials and understand the defects in such structures.</p> <p>CO2: Explain how to tailor material properties of ferrous and non-ferrous alloys.</p> <p>CO3: Quantify mechanical integrity and failure in materials.</p>
19ME45	Manufacturing Processes – I	<p>CO1: Prepare a pattern, riser, and gating system to produce grey cast iron castings using sand molds.</p> <p>Assess solidification process in steel castings in terms of pouring times and cooling times and predict directional solidification and grain growth during cooling.</p> <p>CO2: Differentiate various metal forming processes such as Hot and Cold Working, Rolling, Forging, Extrusion and Drawing</p>

		<p>Processes.</p> <p>CO3: Compute blanking forces, design punches and dies, and develop process plans for makingsheet metal products.</p> <p>CO4: Assess the suitability of using SMAW, GMAW, GTAW, SAW to weld ferrous alloys, and examine the effect of residual stresses and distortion.</p> <p>CO5: Perceive the basics of Powder metallurgy and application of powder metallurgy</p> <p>CO6: Classify different plastic molding processes, Extrusion of Plastic and Thermoforming.</p>
19MEL46	Computer Aided Machine Drawing – II	<p>CO1: Construct the Surface Modelling and the User Coordinate System for a given component</p> <p>CO2: Practice Viewports, Model space, Paper space and Layouts.</p> <p>CO3: Develop Blocks Attributes and External Reference for the mechanical component.</p> <p>CO4: Develop Menus, Macros and Advanced Rendering and Animation.</p> <p>CO5: Practice limits, fits, tolerance and also geometrical tolerance.</p>
19MEL46A	Material Characterization and Testing Laboratory	<p>CO1: Evaluate grain size, morphology, microstructure and microhardness of metals and alloys.</p> <p>CO2: Estimate hardness and conduct impact tests on specimens.</p> <p>CO3: Perform tension, shear, torsion and deflection tests on a given specimen.</p>
19MEL46B	Manufacturing Processes Laboratory	<p>CO1: Identify suitable mold making process and pattern to perform Packing Gland, Bracket, Stepped Pulley, Bend Pipe, Loose Piece and Square Box patterns.</p> <p>CO2: Demonstrate Principle and operations of a center lathe to produce cylindrical components of ferrous metals (mild steel) and apply threading process to generate external V - threads and find the pitch, speed and feed of center lathe.</p> <p>CO3: Apply taper turning process and create a conical shape component made of ferrous and nonferrous metals using center lathe and create a contour shape like concave and convex shapes on cylindrical components of ferrous and non-ferrous using center lathe.</p> <p>CO4: Perform Butt Joint, Lap joint, T Joint, and Corner Joint in mild steel of 3 mm thickness using welding process, also prepare WPS for different joints.</p> <p>CO5: Calculate cutting parameters and generate a spur gear and helical gear of ferrous metals using a milling/gear hobbing machine.</p> <p>CO6: Calculate cutting parameters and generate different shapes using special purpose machines.</p>
19HOC41	Communication Skills for Engineers - II*	<p>CO1: Solve objective questions on analogy, Statement and Argument, Statement and Conclusion, Data Sufficiency and Sentence improvement within a given time.</p> <p>CO2: Construct grammatically correct sentences.</p> <p>CO3: Speak confidently to describe a process, present</p>

		information on the specified topic and disseminate information in a professional manner.
<b>Semester V</b>		
19ME51	Heat and Mass Transfer	<p>CO1: Deduce and estimate heat transfer rate for one dimensional steady and unsteady state heat transfer problems with relevant boundary and initial conditions.</p> <p>CO2: Choose appropriate empirical correlations for convective heat transfer to determine the values of heat transfer coefficients and calculate heat transfer rates.</p> <p>CO3: Calculate the radiation heat exchange between gray surfaces in non-participating media</p> <p>CO4: Classify phase change heat transfer processes and draw analogy between heat and mass transfer mechanisms.</p> <p>CO5: Design a heat sink for a given heat duty and convective heat transfer coefficient</p> <p>CO6: Analyze heat exchangers using LMTD and Effectiveness-NTU methods</p>
19ME52	Design of Machine Elements	<p>CO1: Calculate a suitable size for a specified machine element to withstand a given load and permissible stress conditions (Normal, Shear, torsional combination of normal and shear stresses) using Principal stresses, Theories of failure, Fatigue failure (Soderberg, Goodman and Gerber equations).</p> <p>CO2: Design using factor of safety and permissible stresses, and provide a drawing of a power transmission shaft, Flange, Hub, and Key for a Rigid and Flexible coupling to transmit specified power and torque.</p> <p>CO3: Design a spring (compression, co-axial, Leaf) or a flywheel for various applications (Railway buffer spring, Automobile suspension, Toys, Punching machine) to store energy and prevent unwanted shock and vibrations.</p> <p>CO4: Design metric bolts, rivets and welded joints (diameter, size and thickness) for centrally, axially and eccentrically loaded, unsymmetrical sections, to withstand specified loads.</p> <p>CO5: Design and choose a suitable bearing (ball, roller, or journal) for standard specified loads (axial and radial load) and specified life.</p>
19ME53	Manufacturing Processes – II	<p>CO1: Calculate cutting force, tool life of single point and multi point tools, illustrate cutting tool geometry and chip formation, in orthogonal metal cutting process.</p> <p>CO2: Illustrate operation such as Turning, Facing, Threading, Knurling and Grooving on Centre Lathe and special purpose lathes.</p> <p>CO3: Demonstrate and Produce a component using boring, shaping, planing, drilling, milling, sawing and broaching machines.</p> <p>CO4: Demonstrate the proper setups, uses, and operations associated with the grinding machine, its accessory devices and illustrate gear manufacturing and forming.</p> <p>CO5: Choose and apply advanced machining processes (Chemical Machining, Electro-Chemical Machining, Grinding, Wire EDM, Laser, Electron Beam Machining, Water and</p>

		Abrasive Jet Machining) to produce components from hard and smart materials.
19ME54	Metrology and Quality Control	<p>CO1: Handle various linear and angular measuring instruments and design plug and ring gauges</p> <p>CO2: Demonstrate various measurements in elements of screw thread and gear thread tooth parameters using floating carriage micrometer, gear tooth vernier caliper</p> <p>CO3: Illustrate surface finish measurements and interferometry principles using different types of stylus probe instruments, interferometers, projectors and microscopes</p> <p>CO4: Demonstrate various SQC tools and analyse the data statistically to interpret various control charts and decide upon the action to be taken for controlling quality</p> <p>CO5: Practice the concepts of sampling, constructing OC curves and reliability evaluation for inspection and quality control</p>
19ME55	Operations Research	<p>CO1: Mathematically formulate a given engineering problem as a linear programming problem, and apply Graphical, Simplex, Two-Phase or Big-M methods to obtain the optimal solution.</p> <p>CO2: Construct objective functions and constraints using primal and dual relationship and apply the Dual Simplex Method to obtain optimal solutions.</p> <p>CO3: Justify the determined feasible solution (processing time and transportation cost) as optimal solution using MODI method and Hungarian method.</p> <p>CO4: Determine the optimal project duration and cost using CPM and PERT technique, also construct complex project network and control the complex project.</p> <p>CO5: Categorize (Inventory, Game Theory, Sequencing and Queuing) and solve various decision-making problems using mathematical modelling.</p> <p>CO6: Apply Monte-Carlo simulation technique to solve simple and real time problems.</p>
19MEL56A	Applied Thermal Sciences Laboratory	<p>CO1: Identify and explain components and mechanisms of IC engines.</p> <p>CO2: Conduct performance tests on IC engines, reciprocating compressors and refrigeration systems.</p> <p>CO3: Evaluate performance of refrigeration system</p> <p>CO4: Estimate heat transfer parameters - radiant factor, emissivity, free and forced convection heat transfer coefficients</p> <p>CO5: Estimate thermal conductivity of different solids</p> <p>CO6: Conduct performance tests on pin-fin and heat exchangers</p>
19MEL56B	Dynamics and Metrology Laboratory	<p>Dynamics Laboratory:</p> <p>CO1: Model and analyze the mechanism to evaluate the position, velocity and acceleration using MATLAB.</p> <p>CO2: Demonstrate the working principle of gyroscope, governor and cam.</p> <p>CO3: Examine the balancing of reciprocating mass.</p> <p>CO4: Inspect the critical speed of the shaft under the given load conditions.</p>

		<p>CO5: Determine the vibration response of different systems. Metrology Laboratory</p> <p>CO1: Find angular measurement to set work piece for a desired angle with the help of angle gauges, bevel protractor, sine bar, and slip gauges for inclined components</p> <p>CO2: Calculate various gear tooth parameters like tooth thickness, pitch, profile errors and total composite errors of a given spur gear using gear tooth Vernier caliper.</p> <p>CO3 : Measure screw thread elements - major diameter, minor diameter, effective diameter and pitch using floating carriage micrometer, tool maker's microscope and profile projector for a given threaded component.</p> <p>CO4 : Interpret and analyse data for P-chart, X bar chart and R chart for given specifications and comment on the nature of the process.</p>
19MEL65	CAD / CAM Laboratory	<p>CO1: Produce a 3-D component drawing using basic and advanced levels of modeling techniques in software.</p> <p>CO2: Assemble mechanical engineering components, check for interference and simulate the assembly mechanism.</p> <p>CO3: Generate CNC programs for a given component as per part drawing by integrating through CNC turning and machining center.</p> <p>CO4: Use a real time CNC turning and machining center with Fanuc software to produce components of simple shape.</p> <p>CO5: Select the advanced manufacturing technology solution for a particular application</p>

## Master of Computer Applications

### Programme Outcomes (POs)

The following are Programme Outcomes for the MCA programme:

**PO1:** Graduates will be able to apply knowledge of computing fundamentals, computing specialization and domain knowledge for the abstraction and conceptualization of computing models from defined problems and requirements.

**PO2:** Graduates will have the ability to understand and analyze a given real-world problem and propose feasible computing solutions.

**PO3:** Graduates will be able to analyze customer requirements, create high level design, implement and document robust and reliable software systems.

**PO4:** Graduates will be able to transform complex business scenarios and contemporary issues into problems, investigate, understand and propose integrated solutions using emerging technologies.

**PO5:** Graduates will be able to use the techniques, skills and modern hardware and software tools necessary for innovative software solutions.

**PO6:** Graduates will possess leadership and managerial skills with best professional ethical practices and social concern.

**PO7:** Graduates will recognize the need for self-motivation to engage in lifelong learning.

**PO8:** Graduates will be able to master fundamental project management skills, concepts and techniques, set attainable objectives and ensure positive results, meeting scope, time and budget constraints.

**PO9:** Graduates will be able to communicate technical information effectively, both orally and in writing.

**PO10:** Graduates will be able to recognize the social, professional, cultural, and ethical issues involved in the use of computer technology and give them due consideration in developing software systems.

**PO11:** Graduates will be able to work collaboratively as a member or leader in multidisciplinary teams.

**PO12:** Graduates will be able to assess the need for innovation and initiate the process through entrepreneurship or otherwise.

## Subjects of Study (SOS)

### List of courses offered in 2018 Regulations

<b>Semester I</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
	<b>THEORY</b>					
18MCA11	Theory of Computing	3	0	0	3	FC
18MCA12	Data Structures	3	0	0	3	FC
18MCA13	Programming in C	3	0	0	3	PC
18MCA14	Computer Organization	3	0	0	3	FC
18MCA15	Probability and Statistics	3	0	0	3	PC
	<b>PRACTICALS</b>					
18MCA16	C Programming Laboratory	0	0	4	2	PC
18MCA17	User Experience Laboratory	0	0	4	2	FC
18MCA18	Statistics Laboratory	0	0	4	2	FC
18MCA19	Communication Skills	0	0	2	1	EEC
	<b>TOTAL CREDITS</b>				<b>22</b>	
<b>Semester I</b>						
<b>Course</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
	<b>THEORY</b>					
18MCA21	Design and Analysis of Algorithms	3	0	0	3	FC
18MCA22	Object Oriented Principles and	3	0	0	3	PC
18MCA23	Principles of Operating System	3	0	0	3	PC
18MCA24	Database Management Systems	3	0	0	3	PC
18MCA25	Software Engineering	3	0	0	3	PC
	<b>PRACTICAL</b>					
18MCA26	Algorithms and Operating Systems Laboratory	0	0	4	2	PC
18MCA27	Object Oriented Programming Laboratory	0	0	4	2	PC
18MCA28	RDBMS Laboratory	0	0	4	2	PC
18MCA29	Professional English	0	0	2	1	EEC
	<b>TOTAL CREDITS</b>				<b>22</b>	
<b>Semester III</b>						
<b>Course</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
	<b>THEORY</b>					
18MCA31	Numerical Methods and Applied Statistics	4	0	0	4	FC
18MCA32	Computer Networks	3	0	0	3	PC
18MCA33	Artificial Intelligence	3	0	0	3	PC
18MCA34	SOA and Web Services	3	0	0	3	PC
	Elective I	3	0	0	3	PE
	<b>PRACTICAL</b>					

18MCA35	Advanced Programming Laboratory	0	0	4	2	PC
18MCA36	Artificial Intelligence Laboratory	0	0	4	2	PC
18MCA37	Network Programming Laboratory	0	0	4	2	PC
18MCA38	Personality Development					EEC
	<b>TOTAL CREDITS</b>				<b>22</b>	
<b>Semester IV</b>						
<b>Course</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
	<b>THEORY</b>					
18MCA41	Operations Research	4	0	0	4	FC
18MCA42	Data Mining and Warehousing	3	0	0	3	PC
18MCA43	Accounting and Financial Management	4	0	0	4	PC
	Elective II	3	0	0	3	PE
	Elective III	3	0	0	3	PE
	<b>PRACTICAL</b>					
18MCA44	Data Mining Laboratory	0	0	4	2	PC
	Elective Laboratory	0	0	4	2	PE
18MCA45	Mini Project	0	0	4	2	EEC
	<b>TOTAL CREDITS</b>				<b>23</b>	
<b>Semester V</b>						
<b>Cours</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
	<b>THEORY</b>					
18MCA51	Software Testing and Quality Assurance	3	0	0	3	PC
18MCA52	Cryptography and Network Security	3	0	0	3	PC
	Elective IV	3	0	0	3	PE
	Elective V	3	0	0	3	PE
	Elective VI	3	0	0	3	PE
	<b>PRACTICAL</b>					
18MCA53	Software Testing Laboratory	0	0	4	2	PC
18MCA54	Information Security Laboratory	0	0	4	2	PC
18MCA55	Professional Ethics					EEC
	<b>TOTAL CREDITS</b>				<b>19</b>	
<b>Semester</b>						
<b>Cours</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
18MCA61	Project work and Viva voce				18	EEC
	<b>TOTAL CREDITS</b>				<b>18</b>	
<b>Professional Electives</b>						
<b>Course</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
	<b>INFORMATION TECHNOLOGY ELECTIVES</b>					
18MCAE01	Virtualization and Cloud Computing	3	0	0	3	PE

18MCAE02	Graphics and Multimedia	3	0	0	3	PE
18MCAE03	Advanced Database Management Systems	3	0	0	3	PE
18MCAE04	Distributed Systems	3	0	0	3	PE
18MCAE05	Grid and Cluster Computing	3	0	0	3	PE
18MCAE06	Internet of Things	3	0	0	3	PE
18MCAE07	Software Metrics and Measurement	3	0	0	3	PE
18MCAE08	Agile Methods for Software Development	3	0	0	3	PE
18MCAE09	Open Source Ecosystem	3	0	0	3	PE
18MCAE10	Software Architecture and Design Patterns	3	0	0	3	PE
18MCAE11	Enterprise Management and Computing	3	0	0	3	PE
18MCAE12	Basics of Robotics	3	0	0	3	PE
18MCAE13	GPU and Parallel Programming	3	0	0	3	PE
18MCAE14	Digital Image Processing	3	0	0	3	PE
	<b>MANAGEMENT ELECTIVES</b>					
18MCAE15	Organizational Behavior	3	0	0	3	PE
<b>Course</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
18MCAE16	Principles of Management	3	0	0	3	PE
18MCAE17	Principles of Environmental Science	3	0	0	3	PE
18MCAE18	E-Commerce	3	0	0	3	PE
18MCAE19	Decision Making	3	0	0	3	PE
18MCAE20	Entrepreneurship Development	3	0	0	3	PE
	<b>FINANCIAL TECHNOLOGY ELECTIVES</b>					
18MCAE21	E-Portfolio Management	3	0	0	3	PE
18MCAE22	Financial Techniques and Analysis	3	0	0	3	PE
	<b>DATA SCIENCE ELECTIVES</b>					
18MCAE23	Machine Learning	3	0	0	3	PE
18MCAE24	Data Analytics	3	0	0	3	PE
18MCAE25	Natural Language Processing	3	0	0	3	PE
18MCAE26	Social Network Analysis	3	0	0	3	PE
18MCAE27	Intelligent Information Retrieval	3	0	0	3	PE
18MCAE28	Big Data Technologies	3	0	0	3	PE
	<b>NETWORKING TECHNOLOGY ELECTIVES</b>					
18MCAE29	Ad Hoc Networks	3	0	0	3	PE
18MCAE30	Internetworking Protocols and Management	3	0	0	3	PE
18MCAE31	Mobile Computing	3	0	0	3	PE
18MCAE32	Blockchain Management	3	0	0	3	PE
18MCAE33	Wireless Networks	3	0	0	3	PE
18MCAE34	Internet Of Things: Sensing and Actuator Devices	3	0	0	3	PE
18MCAE35	Algorithmic Design Techniques	3	0	0	3	PE

18MCAE36	Python Programming	3	0	0	3	PE
18MCAE37	Single Page Web Applications	3	0	0	3	PE
18MCAE38	Web Frameworks	3	0	0	3	PE
	<b>LANGUAGE ELECTIVES</b>					
18FY22F	Basic French	3	0	0	3	EEC
18FY22G	Basic German	3	0	0	3	EEC
<b>PROFESSIONAL ELECTIVES - Labs</b>						
<b>Course</b>	<b>Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
18MCAEL01	Mobile Application Development Laboratory	0	0	4	2	PE
18MCAEL02	Graphics and Multimedia Laboratory	0	0	4	2	PE
18MCAEL03	Internet of Things Laboratory	0	0	4	2	PE
18MCAEL04	Natural Language Processing Laboratory	0	0	4	2	PE
18MCAEL05	Social Network Analysis Laboratory	0	0	4	2	PE
18MCAEL06	Virtualization and Cloud Computing Laboratory	0	0	4	2	PE
18MCAEL07	Web Frameworks Laboratory	0	0	4	2	PE
18MCAEL08	Machine Learning Laboratory	0	0	4	2	PE
18MCAEL09	Python Programming Laboratory	0	0	4	2	PE

**List of courses offered in 2020 Regulations**

<b>Semester I</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
20MCA11	Mathematical Foundations of Computer Applications	3	0	0	3	FC
20MCA12	Data Structures and Algorithms	3	0	0	3	FC
20MCA13	Database Management Systems	3	0	0	3	FC
20MCA14	Operating System Principles	3	0	0	3	FC
20MCA15	Software Engineering	3	0	0	3	FC
20MCA16	Data Structures Laboratory	0	0	4	2	FC
20MCA17	Database Management Systems Laboratory	0	0	4	2	FC
20MCA18	Python Programming Laboratory	0	0	4	2	PC
20MCA19	Communication Skills	0	0	2	1	EEC
	<b>Total Credits</b>				<b>22</b>	
<b>Semester II</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
20MCA21	Artificial Intelligence	3	0	0	3	FC
20MCA22	Advanced Java Programming	3	0	0	3	PC
20MCA23	Virtualization and Cloud Computing	3	0	0	3	FC
20MCA24	SOA and Web Services	3	0	0	3	FC
	Elective I	3	0	0	3	PE
20MCA25	Artificial Intelligence Laboratory	0	0	4	2	FC
20MCA26	Advanced Programming Laboratory	0	0	4	2	PC
20MCA27	Professional English	0	0	2	1	EEC
20MCA28	Mini Project	0	0	4	2	EEC
20HAC01	Hackathon	0	0	0	1	EEC
	<b>Total Credits</b>				<b>23</b>	
<b>Semester III</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
20MCA31	Cryptography and Network Security	3	0	0	3	FC
20MCA32	Machine Learning	3	0	0	3	FC
	Elective II	3	0	0	3	PE
	Elective III	3	0	0	3	PE
	Elective IV (Management Elective)	3	0	0	3	PE
20MCA33	Cryptography and Network Security Laboratory	0	0	4	2	FC
20MCA34	Machine Learning Laboratory	0	0	4	2	FC
	Elective Lab	0	0	4	2	PE
20MCAIT01	Inplant Training	0	0	0	1	EEC
	<b>Total Credits</b>				<b>22</b>	
<b>Semester IV</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>

20MCA41	Project work and viva voce	-	-	-	12	EEC
	<b>Total Credits</b>				<b>12</b>	
<b>#One Credit Course</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
20MCAOC01	Recent Trends in Web Technology	1	0	0	1	OC
<b>Professional Electives - IT Electives</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
20MCAE101	Graphics and Multimedia	3	0	0	3	PE
20MCAE102	Advanced Database Management Systems	3	0	0	3	PE
20MCAE103	Distributed Systems	3	0	0	3	PE
20MCAE104	Grid and Cluster Computing	3	0	0	3	PE
20MCAE105	Internet of Things	3	0	0	3	PE
20MCAE106	Software Metrics and Measurement	3	0	0	3	PE
20MCAE107	Agile Methods for Software Development	3	0	0	3	PE
20MCAE108	Software Architecture and Design Patterns	3	0	0	3	PE
20MCAE109	Basics of Robotics	3	0	0	3	PE
20MCAE110	GPU and Parallel Programming	3	0	0	3	PE
20MCAE111	Digital Image Processing	3	0	0	3	PE
20MCAE112	Blockchain Technologies	3	0	0	3	PE
20MCAE113	Single page web applications	3	0	0	3	PE
20MCAE114	Digital Marketing	3	0	0	3	PE
20MCAE115	Software Project Management	3	0	0	3	PE
20MCAE116	Computer Vision	3	0	0	3	PE
20MCAE117	Software Testing and Quality Assurance	3	0	0	3	PE
20MCAE118	Open Source Ecosystem	3	0	0	3	PE
20MCAE119	Enterprise Management and Computing	3	0	0	3	PE
<b>Professional Electives - Data Science Electives</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
20MCAE201	Data Analytics	3	0	0	3	PE
20MCAE202	Intelligent Information Retrieval	3	0	0	3	PE
20MCAE203	Big Data Technologies	3	0	0	3	PE
20MCAE204	Data Mining and Warehousing	3	0	0	3	PE
20MCAE205	Natural Language Processing	3	0	0	3	PE
20MCAE206	Social Network Analysis	3	0	0	3	PE
<b>Professional Electives - Networking Electives</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
20MCAE301	Computer Networks	3	0	0	3	PE
20MCAE302	Internetworking Protocols and Management	3	0	0	3	PE
20MCAE303	Mobile Computing	3	0	0	3	PE
20MCAE304	Wireless networks	3	0	0	3	PE
20MCAE305	Ad Hoc Networks	3	0	0	3	PE
<b>Professional Electives - Management Electives</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>

20MCAE401	Organizational Behaviour	3	0	0	3	PE
20MCAE402	Principles of Management	3	0	0	3	PE
20MCAE403	Accounting and Financial Management	3	0	0	3	PE
20MCAE404	E-Commerce	3	0	0	3	PE
20MCAE405	Decision Making	3	0	0	3	PE
20MCAE406	Entrepreneurship Development	3	0	0	3	PE
20MCAE407	Principles of Environmental Science	3	0	0	3	PE
<b>Professional Electives Laboratories</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
20MCAEL01	Mobile Application Development Laboratory	0	0	4	2	PE
20MCAEL02	Graphics and Multimedia Laboratory	0	0	4	2	PE
20MCAEL03	Internet of Things Laboratory	0	0	4	2	PE
20MCAEL04	Data Analytics Laboratory	0	0	4	2	PE
20MCAEL05	Data Mining Laboratory	0	0	4	2	PE
20MCAEL06	GPU and Parallel Programming Laboratory	0	0	4	2	PE
20MCAEL07	Image Processing Laboratory	0	0	4	2	PE
20MCAEL08	Web Frameworks Laboratory	0	0	4	2	PE
20MCAEL09	Natural Language Processing Laboratory	0	0	4	2	PE
20MCAEL10	Social Network Analysis Laboratory	0	0	4	2	PE
20MCAEL11	Networks Programming Laboratory	0	0	4	2	PE
20MCAEL12	Digital Marketing Laboratory	0	0	4	2	PE
<b>BRIDGE COURSE ** - SEMESTER I</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
20MCAB11	Basics of Data Structures	1	0	0	0	FC
20MCAB12	Programming in C	1	0	0	0	FC
20MCAB13	Computer Hardware and Organization	1	0	0	0	FC
<b>BRIDGE COURSE ** - SEMESTER II</b>						
<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Category</b>
20MCAB21	Basics of Internet	1	0	0	0	FC
20MCAB22	Software Project Management	1	0	0	0	FC
20MCAB23	Object Oriented Programming in C++	1	0	0	0	FC

## Course Outcomes (2018 Regulations)

### Course Outcomes

S.No	Course Code	Course Outcomes
1.	18MCA11	<p>CO1 : Understand different types of grammars and develop grammars to produce specific solutions</p> <p>CO2 : Understand and develop designs for different machine types: finite automata, pushdown automata and Turing machines.</p> <p>CO3 : Relate Partial recursive functions and Programming language design.</p> <p>CO4 : Identify the paradigms of programming languages.</p> <p>CO5 : Analyze the concepts of various components of programming languages and their interactions</p>
2.	18MCA12	<p>CO1 : Choose and design data structures such as array, linked list, stack, queue, trees and graphs to effectively model information in a problem.</p> <p>CO2 : Choose and apply operations like insertion, deletion, traversal and searching mechanism on various data structures relevant to a problem.</p> <p>CO3 : Judge efficiency trade-offs between data structures.</p> <p>CO4 : Apply standard algorithms for searching and sorting based on given problem.</p> <p>CO5 : Apply algorithm analysis techniques to evaluate performance of an algorithm.</p>
3.	18MCA13	<p>CO1 : Analyze the given problem statement and develop an algorithm with the properties of finiteness, completeness and correctness.</p> <p>CO2 : Understand the constructs of C programming language and apply them to develop simple C programs.</p> <p>CO3 : Choose the suitable data type among Arrays, Pointers, Structure, Union, File to store and manipulate the data.</p> <p>CO4 : Analyze the given problem, divide it into modules and represent them using functions.</p> <p>CO5 : Design and develop programs based on given user requirements.</p>
4.	18MCA14	<p>CO1 : Demonstrate how to add and multiply integers and floating-point numbers using two's complement and IEEE floating point representation.</p> <p>CO2 : Equipped with the knowledge of register level computer operations , working of control memory and micro program.</p> <p>CO3 : Analyze and model the structure and functional units of digital computer, including overall system architecture, register requirements and digital components.</p> <p>CO4 : Analyze different ways of communicating with I/O devices and standard I/O interfaces.</p>

		C05 : Given a CPU organization, design a memory module for a given specification
5.	18MCA15	<p>C01 : Understand basic statistical concepts and measures.</p> <p>C02 : Apply the concepts of probability, distributions and sampling to different problems.</p> <p>C03 : Formulate and test the hypothesis about means, variances and proportions and draw conclusions based on the results of statistical tests.</p> <p>C04 : Associate random variables and distributions and to apply the principles of regression and correlation.</p> <p>C05 : Categorize and define sampling methods.</p>
6.	18MCA16	<p>C01 : Solve the given problem by devising an algorithm and implement using C</p> <p>C02 : Write, compile and debug programs in C.</p> <p>C03 : Develop reusable and efficient solutions using appropriate operators, control structures, functions and/or recursive functions in C.</p> <p>C04 : Design and implement basic operations on data structures.</p> <p>C05 : Develop a simple project in application or system domain using C.</p>
7.	18MCA17	<p>C01 : Design web pages using HTML/DHTML and style sheets.</p> <p>C02 : Develop and enhance static and dynamic web pages using CSS,JSP and PHP.</p> <p>C03 : Design and add functionalities to client and server side web pages with cookies, database connectivity and ActiveX control.</p> <p>C04 : Design and develop interfaces and apply techniques for navigation.</p> <p>C05 : Understand the differences between usability and user experience.</p>
8.	18MCA18	<p>C01 : Understand and apply various statistical functions in Excel.</p> <p>C02 : Use SCILAB/R for solving mathematical problems.</p> <p>C03 : Perform data analysis for real world problems by applying statistical techniques.</p> <p>C04 : Understand commands in EXCEL and SCILAB/R to perform matrix operations.</p> <p>C05 : Present data using graphs and charts and interpreting them.</p>
9.	18MCA19	<p>C01 : Apply each of the Syllable, Stress, Accent and Intonation Rules and all of the phonetic patterns and use appropriate patterns in a given situation or passage. Reconstruct a given sentence into a phonetic transcription.</p> <p>C02 : Apply the rules of grammar viz., Parts of Speech, Idioms, Phrasal Verbs, Concord, Cause and Effect and Purpose and Function and rewrite the given technical passage correcting the errors.</p> <p>C03 : Categorize the barriers to communication, formulate solutions and justify, plan, structure and present a 15</p>

		<p>minutes presentation on technical topic given a communication context.</p> <p>C04 : Interpret the given graphical representation and compose passages. Summarize a technical text of 300 to 400 words into one third, write the process of working of an equipment, and given a social context compose appropriate dialogues using functional words.</p> <p>C05 : Specify appropriate responses and construct a summary, given short monologues and conversations.</p>
10.	18MCA21	<p>C01 : Understand the performance of a problem by using different algorithmic design techniques.</p> <p>C02 : Relate new data structures by augmenting existing data structures, and design algorithms that employ data structures.</p> <p>C03 : Identify the problem given and design the algorithm using various algorithm design techniques like Divide and Conquer, Greedy method, Dynamic Programming, Backtracking and Branch and Bound Technique.</p> <p>C04 : Understand and implement a variety of advanced data structures (AVL Tree, Multiway Tree, B Tree, B+ Tree, Red, Black Tree).</p> <p>C05 : Analyze and apply design techniques and make judgments about which particular design technique will improve performance of a problem</p>
11.	18MCA22	<p>C01 : Express in-depth knowledge on the basic features of Java Language like identifiers, keywords, operators, control structures and classes</p> <p>C02 : Apply all the object oriented concepts using language feature like classes, inheritance, packages, exception handling and interfaces.</p> <p>C03 : Implement concurrent programming techniques using Multi-Threading concept</p> <p>C04 : Create applications with efficient GUI programming and Event Handling</p> <p>C05 : Develop applications supported with back end programming in support with conventional databases</p>
12.	18MCA23	<p>C01 : Demonstrate the structure of operating system, batch programming, system calls and virtual machines</p> <p>C02 : Demonstration of Kernel Management specific to concurrent process for Inter Process Communication systems</p> <p>C03 : Estimate system performance through scheduling algorithms - FIFO, round robin, priority, shortest job first</p> <p>C04 : Recognize memory allocation and de-allocation for both static and dynamic storage</p> <p>C05 : Design and develop a new simple File System using Disk and File System Management</p>
13.	18MCA24	<p>C01 : Identify the components of RDMS software and its</p>

		<p>significance.</p> <p>C02 : Analyze the data requirements and create conceptual design of the database using Entity Relationship model.</p> <p>C03 : Identify functional dependencies and apply normalization techniques to optimize the data design.</p> <p>C04 : Write SQL queries based on the functional requirements of any real world database applications.</p> <p>C05 : Implement different concurrency control techniques in transactions and recovery mechanisms used in database.</p>
14.	18MCA25	<p>C01 : Choose applicable software life-cycle model to develop software for given customer need and justify choice with reference to complexity, cost and time.</p> <p>C02 : Determine software requirements based on customer need and develop industry standard Software Requirement Specification (SRS) document</p> <p>C03 : Construct models using functional and object oriented design principles, concepts and tools based on SRS document.</p> <p>C04 : Prepare suitable structural and behavioural analysis models based on SRS document.</p> <p>C05 : Formulate test cases and test data using white box and black box techniques to deliver defect free software.</p>
15.	18MCA26	<p>C01 : Choose appropriate data structure, design and analyze based on time and space complexity for a given problem.</p> <p>C02 : Design and implement recursive algorithms</p> <p>C03 : Apply appropriate sorting and searching techniques with respect to given problem.</p> <p>C04 : Use command line argument and interactive inputs for implementing shell scripts and the use of system calls in a Linux/Unix environment.</p> <p>C05 : Understand and appreciate OS principles in the design and implementation of process management, inter-process communication.</p>
16.	18MCA27	<p>C01 : Determine the object entities, their data members and relate them in various forms for achieving the objectives of the given scenario.</p> <p>C02 : Create the concept of hierarchy among objects and the various ways of implementing them</p> <p>C03 : Design applications which decides on the data members at runtime using polymorphic features</p> <p>C04 : Model the application with concurrent features for effective faster performance</p> <p>C05 : Develop efficient interactive forms for user interaction using language specific components and communicate with databases to store and extract data from them</p>
17.	18MCA28	<p>C01 : Design the conceptual data model as Entity Relationship diagram and create the database using DDL statements for a given application</p> <p>C02 : Formulate simple DML SQL queries to retrieve the</p>

		<p>required data for real world applications</p> <p>C03 : Generate DML queries using Sub Queries, Joins, Group By, Order By and Aggregate functions to filter and aggregate the data of the real world applications</p> <p>C04 : Construct reusable PL/SQL blocks with Functions, Procedures, Packages, Triggers, Exception Handling, and Cursors as required by OLTP applications</p> <p>C05 : Develop a database project by constructing ER model, Creating Tables and write SQL and PL/SQL blocks using RDBMS software.</p>
18.	18MCA29	<p>C01 : Given a Business Communication context, compose business letters, reports and emails with suitable format. Given a job requirement, prepare a job application letter with a Resume or a CV.</p> <p>C02 : For a given organizational conflict task, assess the problem, analyze the approaches of team members and devise solutions to resolve the conflict. For a given workplace situation or problem, generate ideas, express and exhibit communication and interpersonal skills.</p> <p>C03 : For a given scenario, generate creative ideas and give a 5 minute presentation. For a given HR topic, generate valid points for and against the topic and present them with appropriate group behaviour. For any job requirement, plan and prepare for a 20 minute mock interview.</p> <p>C04 : Construct appropriate responses to greet, transfer, place the caller on hold, inquiries, call backs, unintentional disconnects, interruptions, using suitable telephoning etiquette. Given a business communication scenario, construct a suitable strategy and action plan using specific negotiation tactics consistent with the objectives of the negotiator.</p> <p>C05 : Apply the rules of grammar viz Tenses, Phrasal verbs, Idioms and phrases, Preposition, and Pronoun and correct the errors in a given passage.</p>
19.	18MCA31	<p>C01 : Familiarize with application of numerical methods in solving equations occurring in business modeling and good understanding of empirical modeling by using various numerical methods for data analysis.</p> <p>C02 : Interpret basic principles of experimental design.</p> <p>C03 : Understand basic components of time series data and use them for forecasting.</p> <p>C04 : Construct control charts for statistical quality control and be able to use reliability concepts to calculate reliability parameters and estimate the system reliability.</p> <p>C05 : Apply non-parametric tests in analyzing data.</p>
20.	18MCA32	<p>C01 : Identify the components required to build different types of networks and have an understanding of network models.</p> <p>C02 : Analyze the layered functionality and data communication</p>

		<p>mechanisms used between nodes.</p> <p>C03 : Identify the protocols involved at the various layers and demonstrate the role of each protocol.</p> <p>C04 : Analyze and describe the working principles of Internet.</p> <p>C05 : Apply various routing protocols, demonstrate the best routing between nodes and describe the network functionalities for a given application</p>
21.	18MCA33	<p>C01 : Apply various heuristic search strategies in optimal decision making</p> <p>C02 : Understand uncertainty in real world situations.</p> <p>C03 : Employ first order logic for building knowledge base and demonstrate reasoning on this</p> <p>C04 : Express different planning strategies to deal with problems, describe and apply various knowledge representation techniques.</p> <p>C05 : Apply machine learning approaches</p>
22.	18MCA34	<p>C01 : Understand and use the concepts of Service-Oriented Architecture for building platform independent distributed applications.</p> <p>C02 : Design and develop simple to complex web services by analyzing the requirements of web applications.</p> <p>C03 : Apply the concepts of RESTful web services and create dynamic web applications</p> <p>C04 : Determine the security requirements of web services and incorporate them in building web applications.</p> <p>C05 : Examine the requirements of distributed applications, identify and justify the need for using web services.</p>
23.	18MCA35	<p>C01 : Identify and define the computing requirements using appropriate Java and web programming tools for a given problem and configure the tools as needed.</p> <p>C02 : Design, implement, and evaluate integrated modular system using java language specific features</p> <p>C03 : Demonstrate the effective use of complex data structure utility in Java.</p> <p>C04 : Implement technologies of abstract and dynamic programming using request and response servlets</p> <p>C05 : Use methods to connect to unconventional database system and interact with it.</p>
24.	18MCA36	<p>C01 : Design and implement heuristic procedures.</p> <p>C02 : Develop constraint satisfaction solution using a tool.</p> <p>C03 : Design and implement natural language processing responses to English phrases.</p> <p>C04 : Design and implement knowledge based system.</p> <p>C05 : Become familiar with use of AI tool.</p>
25.	18MCA37	<p>C01 : Understand key protocols that support communication.</p> <p>C02 : Develop and implement connection-oriented and connection-less communication using Socket API for a given set of requirements.</p>

		<p>C03 : Develop and implement concurrent and iterative servers and analyze their functionality.</p> <p>C04 : Apply advanced programming techniques such as Broadcasting and Multicasting.</p> <p>C05 : Develop and implement simple network applications using NS-2 API for a given set of requirements and demonstrate its working.</p>
26.	18MCA41	<p>C01 : Solve Linear programming problem, Transportation and Assignment problem.</p> <p>C02 : Discuss elementary Inventory models, Price break models and Safety stock problems.</p> <p>C03 : Categorize Queuing models and also simulate the problems using Monte Carlo technique.</p> <p>C04 : Analyze network models using CPM and PERT and to discuss the replacement problems.</p> <p>C05 : Apply sequencing and replacement concepts in solving Resource allocation problems</p>
27.	18MCA42	<p>C01 : Examine a given dataset identify the analysis goals and providing data mining solutions to achieve those goals.</p> <p>C02 : Choose proper pre-processing techniques by studying the characteristics of the attributes of the dataset and prepare it for data mining.</p> <p>C03 : Apply association rule mining techniques such as Apriori and FP-Tree to a given dataset and generate association rules from it.</p> <p>C04 : Analyze the suitability of classification (Decision Tree) and clustering algorithms(K-Means and K-Medoids) for a given data analysis requirement.</p> <p>C05 : Mine hidden patterns from the dataset after applying pre-processing techniques and derive inference from the results of mining.</p>
28.	18MCA43	<p>C01 : Prepare books of accounts and verify correctness using trial balance, for any business organization.</p> <p>C02 : Prepare statements of final accounts to ascertain the profit,forany trading or manufacturing organization.</p> <p>C03 : Perform cost estimation and determine the optimum cost/price/profit for a firm using Cost Sheet, CVP analysis and Marginal Costing Techniques.</p> <p>C04 : Prepare financial statements using ratio analysis, budgeting, working capital management, capital budgeting and budgetary control techniques and present facts to assist in strategic decision making, given a set of investment options for a business.</p> <p>C05 : Develop software solutions to automate a given accounting, costing or financial process, using MS-Excel.</p>
29.	18MCA44	<p>C01 : Learn to use open source data mining tools such as Weka and/Rapidminer and build data mining applications using these tools.</p> <p>C02 : Select appropriate data pre-processing techniques to be</p>

		<p>applied on standard datasets from various domains such as healthcare, finance, insurance etc and prepare the data for the mining process based on the analysis goal.</p> <p>C03 : Apply association rule mining techniques to derive useful and new pattern information from the given datasets.</p> <p>C04 : Apply classification algorithms to classify a given dataset and derive useful and new insights from the dataset.</p> <p>C05 : Represent the analysis results using different visualization methods such as charts, graphs etc.</p>
30.	18MCA45	<p>C01 : Analyze different domains, identify problems that require software solutions and justify.</p> <p>C02 : Choose appropriate problem solving techniques for the identified problem.</p> <p>C03 : Practice software engineering principles and programming skills in developing software solutions.</p> <p>C04 : Test the developed software to ensure compliance of requirements.</p> <p>C05 : Write the project report demonstrating the contribution and complete technical details</p>
31.	18MCA51	<p>C01 : Analyze different approaches to test software, and select applicable techniques for different situations and projects.</p> <p>C02 : Prepare a software quality plan for a software project considering process evaluation models including issues related to change management, configuration management, verification and validation, and measurement.</p> <p>C03 : Design test plans, create test procedures and design measures to evaluate result of tests.</p> <p>C04 : Apply black box and white box testing techniques at various testing levels for given requirements to achieve adequacy criteria.</p> <p>C05 : Use standards, models and techniques aimed at achieving quality assurance in different software development Environments</p>
32.	18MCA52	<p>C01 : Understand the basic principles of security and develop simple cryptosystems using classical ciphers</p> <p>C02 : Analyze the adequate basic security required by any computing system and apply cryptography algorithms to protect the confidentiality of information resources across networks</p> <p>C03 : Analyze security policies and best practices and apply suitable security technique to achieve integrity, and nonrepudiation of information</p> <p>C04 : Demonstrate an understanding of threats and vulnerabilities of network security and apply suitable security controls to protect internal and external networks</p> <p>C05 : Understand threats against various system components and choose a best technique to control the threat.</p>

33.	18MCA53	<p>C01 : Analyze given requirements, identify suitable testing techniques and develop test cases and test data for testing.</p> <p>C02 : Write test cases for functional testing, execute test cases and interpret results for a given requirement.</p> <p>C03 : Design and develop test cases for testing web and mobile applications.</p> <p>C04 : Use CASE tools to develop requirements, design and develop test related artifacts applicable across the SDLC given a business need.</p> <p>C05 : Use metrics tool to measure software and interpret results.</p>
34.	18MCA54	<p>C01 : Analyze the classical crypto systems used for the confidential information exchange and use different ciphers in secure data transfer</p> <p>C02 : Analyze security best practices and techniques to preserve confidentiality of information at rest, and in transit and apply suitable cryptographic algorithm to preserve the confidentiality of information</p> <p>C03 : Apply hash and message digest algorithms to preserve the integrity of information</p> <p>C04 : Apply standard digital signature scheme to verify the authenticity of information and use Steganography to hide secret messages</p> <p>C05 : Devise suitable defensive measures for securing confidentiality, integrity and authenticity of information resources for different enterprises including Government, Industry, Academia and Society</p>
35.	18MCA55	<p>C01 : Given a problem scenario, analyses the situation and suggest solutions based on human values like honesty, courage, empathy, character and morality.</p> <p>C02 : When presented with a moral dilemma, critically analyses and present solutions using theories of moral autonomy and theories of right action.</p> <p>C03 : Examine a given scenario in the professional life of an Engineer and present a critical note on possible behaviors using professional codes of conduct of Engineers.</p> <p>C04 : Engage in informed critical reflection on the nature of professionalism and ethical challenges inherent in professionalism in matters relating to collegiality, loyalty, occupational crime, confidentiality and conflicts of interest.</p> <p>C05 : When presented with case on moral issues relating to weapons development or such matters of conflicting interest, critical evaluation of the case using the various professional codes of conduct and present ethical solutions.</p>
36.	18MCA61	<p>C01 : Comprehensively demonstrate understanding of the software development processes and practices.</p> <p>C02 : Work to a professional standard in a specified role.</p>

		<p>C03 : Contribute effectively/co-operatively within a team.</p> <p>C04 : Exhibit industry-standards of professionalism in their work through knowledge or use of latest techniques and tools.</p> <p>C05 : Reflect on the work done and own role and present their work through a report and formal viva.</p>
37.	18MCAE01	<p>C01 : Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure.</p> <p>C02 : Describe various service delivery models of cloud computing architecture.</p> <p>C03 : Deploy applications over commercial cloud computing infrastructures such as Amazon Web Services and Google AppEngine.</p> <p>C04 : Describe the virtualization technology behind the working of cloud computing.</p> <p>C05 : Identify security and privacy issues in cloud computing and devise appropriate security solutions for protecting cloud resources.</p>
38.	18MCAE02	<p>C01 : Understand the importance and working of the basic graphical I/O devices and their improved versions.</p> <p>C02 : Employ point, line and circle scan conversion algorithms for drawing outline &amp; filled graphical object.</p> <p>C03 : Construct a world coordinate scene from its constituent elements (defined in their local coordinate systems) by applying geometric transformations on the constituent elements.</p> <p>C04 : Determine the clipping operations required to change from the current display to a new display-when interactive operations through keyboard or mouse are performed.</p> <p>C05 : Analyze the performance of image, video, audio, text and graphics data compression techniques.</p>
39.	18MCAE03	<p>C01 : Analyze the background processes involved in queries and determine their impact on database operations and design.</p> <p>C02 : Analyze different methods and techniques for parallel and distributed query processing and apply appropriate algorithms for optimizing query execution.</p> <p>C03 : Demonstrate the usage of different architecture and design strategies for distributed and parallel databases.</p> <p>C04 : Apply the concepts of NoSQL for enterprise applications.</p> <p>C05 : Design data models for advanced applications using object oriented and other databases.</p>
40.	18MCAE04	<p>C01 : Analyze the advantages and disadvantages of various models for a distributed system</p> <p>C02 : Compare Remote Procedure Call and Remote Method Invocation from the perspective of developing distributed applications</p> <p>C03 : Describe the role of distributed Operating System and</p>

		<p>distributed File System in developing distributed systems</p> <p>C04 : Design the process of discovering and locating distributed objects using Naming and Directory services</p> <p>C05 : Demonstrate the concurrency control mechanism for distributed transactions</p>
41.	18MCAE05	<p>C01 : Understand the basics of distributed systems and programming models.</p> <p>C02 : Examine grid computing architecture and its components.</p> <p>C03 : Apply concepts of grid computing and build distributed applications.</p> <p>C04 : Access and Identify the need for cluster computing.</p> <p>C05 : Design cluster computing based solutions for real world problems by incorporating load balancing.</p>
42.	18MCAE06	<p>C01 : Assess the different IoT technologies that suits an application.</p> <p>C02 : Recognize the challenges for smart object.</p> <p>C03 : Demonstrate knowledge of main architectures and paradigms for the Internet of Things.</p> <p>C04 : Demonstrate knowledge of MAC and routing protocols developed for Low Power and lossy networks.</p> <p>C05 : Design simple IoT systems for the given requirements comprising sensors- edge devices- wireless network connections and data analytics capabilities.</p>
43.	18MCAE07	<p>C01 : Analyse the problem to ascertain the type of software measurement.</p> <p>C02 : Apply selected statistical methods and enlist the findings of analysis.</p> <p>C03 : Design and tailor the selected metric to match the information reliability need.</p> <p>C04 : Determine a plan to decide what data to collect and who should collect it.</p> <p>C05 : Interpret and communicate the metric results.</p>
44.	18MCAE08	<p>C01 : Ascertain the need of software development methodologies with agility and self adaptability features to develop the software which meets the user needs.</p> <p>C02 : Compare the practices followed in different agile methodologies and choose the suitable methodology for a given project</p> <p>C03 : Synthesize the various agile methodology practices to produce a methodology for a project</p> <p>C04 : Develop the system by employing test first programming concept using Junit framework</p> <p>C05 : Develop a simple application using Scrum or XP methodology</p>
45.	18MCAE09	<p>C01 : Know about the professional management and implementation of Open Source Technologies</p> <p>C02 : Analyse the differential combination of new technologies with the matured ones</p> <p>C03 : Decide on the boundaries of business which the web</p>

		<p>changed from building the business case to doing hands-on experimentation</p> <p>C04 : Self teach the issues faced in transitioning to the new technologies, ranging from business to social concern.</p> <p>C05 : Understand roles for open source software in any organization</p>
46.	18MCAE10	<p>C01 : Ascertain the need for Software Architecture and its features to develop software that meets user needs.</p> <p>C02 : Choose the suitable architectural style for a given project</p> <p>C03 : Synthesize the various architectural styles to produce a quality project</p> <p>C04 : Develop system by employing Design Patterns.</p> <p>C05 : Develop a simple application using Software Architecture and Design Pattern.</p>
47.	18MCAE11	<p>C01 : Make computing available as a utility under internet.</p> <p>C02 : Understand the fundamentals of enterprise architecture and enterprise computing.</p> <p>C03 : Implement programming paradigms under cloud like MapReduce.</p> <p>C04 : Describe the emerging development paradigms and technologies and discuss how these will change the way the enterprise applications should be architected.</p> <p>C05 : Understand the benefits the open source has on enterprise computing.</p>
48.	18MCAE12	<p>C01 : Understand the architecture of robots by learning paradigms and intelligence.</p> <p>C02 : Apply the Forward and Inverse Kinematics of manipulators and understand the dynamics in locomotion control and trajectory generation.</p> <p>C03 : Program an application for industrial robots.</p> <p>C04 : Synthesize the Machine Intelligence in robots by studying the functions of industrial manipulators using AI approach.</p> <p>C05 : Understand the automation in robotics by using drive system for gripper movement</p>
49.	18MCAE13	<p>C01 : Understand the basic concepts of super-computing and parallel programming architecture</p> <p>C02 : Identify the difference between serial and parallel programming needs to solve real-time problems.</p> <p>C03 : Demonstrate the ability to use GPUs for parallel programming to solve compute intensive tasks.</p> <p>C04 : Identify CUDA architecture and its components.</p> <p>C05 : Apply parallel programming methods and solve problems using CUDA platform</p>
50.	18MCAE14	<p>C01 : Describe different modalities and current techniques in image processing</p> <p>C02 : Provide mathematical foundations for digital manipulation of image acquisition- preprocessing- enhancement segmentation and compression.</p>

		<p>C03 : Apply image processing techniques in both the spatial and frequency (Fourier) domains</p> <p>C04 : Develop and compare various Image Compression and Decompression Techniques</p>
51.	18MCAE15	<p>C01 : Given a case study, analyze the behavior of the individual.</p> <p>C02 : Given a case study, analyze the behavioral pattern of group interaction in organization</p> <p>C03 : Given a scenario in an organization assess the attitude and personality of the individuals in the organization.</p> <p>C04 : Given a business problem form groups and finds a solution to the problem.</p> <p>C05 : Given a problem in an organization, apply emotional intelligence and solve the problem</p>
52.	18MCAE16	<p>C01 : Describe the principles of management.</p> <p>C02 : Prepare a decision tree for a given statement.</p> <p>C03 : Given a business plan, specify the management functions (planning- organizing- controlling and evaluating)</p> <p>C04 : Construct the organizational chart for given company.</p> <p>C05 : Prepare a flow chart of the selection process of a given company</p>
53.	18MCAE17	<p>C01 : Predict the values of biodiversity for the sustainable development.</p> <p>C02 : Design the methods for the prevention of environmental pollution and solid waste management.</p> <p>C03 : Illustrate the use of alternate energy resources for growing energy needs.</p> <p>C04 : Classify the environmental segments, the causes for its deterioration, he measure taken for its prevention and the need for sustainable development.</p> <p>C05 : Identify the threats to environment, social issues related to it, the necessity for environmental legislation, sustainable development and the applications of bio technology and green chemistry for environmental protection.</p>
54.	18MCAE18	<p>C01 : Specify Infrastructural requirements &amp; Business models for an e-commerce start up. (From the prespective of Indian Businesses)</p> <p>C02 : Analyze different types of e marketing and e advertising stategies and e-payment alternatives commonly used in the industry and summarize the relative merits in Indian socio economic scenario.</p> <p>C03 : Discuss trends in CRM- SCM and Knowledge Management using web technologies and point out the suitable adaptations for a medium scale e-commerce firm in India.</p> <p>C04 : Appraise the impact of different types of mobile and wireless technologies on success of e-commerce in India.</p> <p>C05 : Understand ERP and EDI technologies can transform the Indian Business environment into paperless, cashless, easy-to-manage and regulated, with the use of cloud and open source technologies.</p>

55.	18MCAE19	<p>C01 : Critically discuss different theories and theoretical perspectives in leadership - negotiation and decision making.</p> <p>C02 : Evaluate models to describe how leaders are perceived (leadership style)-analyse a leader's decision-making and role in negotiations.</p> <p>C03 : Analyse how decision-making and strategies in negotiations affect a leader's perception</p> <p>C04 : Use decision making tools to quantitatively analyse its impacts in a given situation.</p> <p>C05 : Apply programmed and non-programmed decisions to effectively manage uncertainty.</p>
56.	18MCAE20	<p>C01 : Highlight the characteristics of a successful entrepreneur</p> <p>C02 : Understand the role of entrepreneurship in the economic development of a country</p> <p>C03 : Formulate the business plans for an efficient and successful business</p> <p>C04 : Justify the need for developing rural entrepreneurship and agri-preneurship in India</p> <p>C05 : State the economic factors influencing the emergence and development of entrepreneurship in a country</p>
57.	18MCAE21	<p>C01 : Understand market efficiency and Investment Process.</p> <p>C02 : Manage investment portfolios and optimally diversify portfolios.</p> <p>C03 : Access quantitative and qualitative skills necessary for the construction- revision and Security evaluation of financial portfolios.</p> <p>C04 : Apply forecasting process and construct the portfolio.</p> <p>C05 : Evaluate investment strategies and predict the market position.</p>
58.	18MCAE22	<p>C01 : Understand some financial aspects of a business firm.</p> <p>C02 : Devise a method for organized collection of data according to logical and consistent accounting procedures.</p> <p>C03 : Interpret the balancing figures for knowing the assets position and reveal the activities of cash inflow and outflow.</p> <p>C04 : Review the operational performance and draw conclusions.</p> <p>C05 : Knowledge on improvement of a business entity using trend analysis.</p>
59.	18MCAE23	<p>C01 : Recognize fundamental issues and challenges of machine learning : data, model selection, model complexity, supervised and unsupervised learning.</p> <p>C02 : Understand and apply Decision trees and Artificial Neural Networks.</p> <p>C03 : Distinguish the strength and weakness of Bayesian learning.</p> <p>C04 : Analyze and apply Instance based learning, Genetic algorithms and rule based learning.</p>

		C05 : Assess capability of Reinforcement learning and study its application.
60.	18MCAE24	C01 : Outline the definitions, concepts and enabling technologies of data analytics. C02 : Analyze different statistical analysis techniques to be applied on different types of datasets. C03 : Develop regression models using R for a given dataset. C04 : Apply text analysis methods to analyze unstructured data. C05 : Create solutions for real world business problems and effectively present results using data visualization techniques.
61.	18MCAE25	C01 : Understand core algorithms and data structures used in NLP. C02 : Utilize corpora and annotations added to them. C03 : Build statistical NLP components- such as n-gram language models- text classifiers and part-of-speech taggers- that learn from such corpora. C04 : Evaluate the merits of different machine learning methods for given NLP tasks. C05 : Appreciate the relationship between linguistic representations and computational applications.
62.	18MCAE26	C01 : Understand concept of semantic web and related applications. C02 : Represent knowledge using ontology. C03 : Evaluate importance of human behaviour in social web and related communities. C04 : Understand importance of trust and privacy in social networks. C05 : Apply techniques for visualization of social networks.
63.	18MCAE27	C01 : Understand algorithms and techniques for information retrieval. C02 : Design a search engine or any text retrieval system. C03 : Apply data mining techniques and quantitative evaluation methods for IR systems. C04 : Develop applications with retrieval capabilities. C05 : Combine aspects of information visualization and mining for information retrieval and web information retrieval.
64.	18MCAE28	C01 : Build single and multi-node Hadoop clusters on Linux or Windows platform C02 : Use Hadoop file system commands to load and execute programs on it. C03 : Write map-reduce programs for data intensive applications and execute them on the Hadoop platform. C04 : Use NoSQL databases like MongoDB in data processing applications. C05 : Choose appropriate big data technologies to analyse big data for a given analytic requirement.
65.	18MCAE29	C01 : Describe unique issues in ad-hoc networks and MAC protocols and their classifications.

		<p>C02 : Discuss challenges in designing routing and transport protocols for ad-hoc networks.</p> <p>C03 : Demonstrate familiarity with common wireless sensor node architecture and the organization of MAC protocols developed for WSN.</p> <p>C04 : Demonstrate knowledge of routing in WSN and to analyze and classify wireless mesh networks.</p> <p>C05 : Develop simple routing solutions for ad-hoc- WSN and mesh networks.</p>
66.	18MCAE30	<p>C01 : Illustrate the working principles of link layer and network layer protocols used for data communication in the Internet.</p> <p>C02 : Determine the suitability of User Datagram Protocol for the given application in terms of reliability and Performance.</p> <p>C03 : Understand and experiment the working of Transmission Control Protocol for the given application based on its requirements.</p> <p>C04 : Analyze the requirements for monitoring and controlling a network using Simple Network Management Protocol and the Management Information Base.</p> <p>C05 : Develop TCP and UDP based socket programs for the given client server communication scenario.</p>
67.	18MCAE31	<p>C01 : Describe wireless and mobile computing systems and analyze the architecture- functions and emerging techniques in GSM</p> <p>C02 : Understand the issues and techniques used in the design of MAC for Wireless communication.</p> <p>C03 : Explain the structure and components for Mobile IP and mobility management</p> <p>C04 : Describe the types and functionalities of transport and application layer services for wireless communication</p> <p>C05 : Develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.</p>
68.	18MCAELO 1	<p>C01 : Use the components of Android development environment for mobile application development</p> <p>C02 : Design GUI forms using layouts,views, event handling, notifications and content providers in Android studio.</p> <p>C03 : Implement database applications using SQLite and perform CRUD operations</p> <p>C04 : Develop mobile applications that make use of camera and media player in Android.</p> <p>C05 : Use location based services, network services and graphics to develop innovative mobile apps.</p>
69.	18MCAELO 2	<p>C01 : Design graphical primitives using algorithms</p> <p>C02 : Develop 2D Transformations.</p> <p>C03 : Design interactive graphics applications.</p> <p>C04 : Design objects and layers for scene in animation.</p>

		C05 : Develop animated application software.
70.	18MCAELO 3	<p>C01 : Choose the required sensor and perform calibration, for a given requirement.</p> <p>C02 : Devise interface circuit for connecting a chosen sensor to Galileo board.</p> <p>C03 : Develop software for Galileo board to interact with the sensor to meet requirements.</p> <p>C04 : Develop software to interact(send/receive data) with Web/Application server located in the Internet.</p> <p>C05 : Use data analytics tool to analyze the data collected and present the report to the end user.</p>
71.	18MCAELO 4	<p>C01 : Apply basic algorithms in the area of Natural Language Processing.</p> <p>C02 : Perform morphological analysis on text.</p> <p>C03 : Apply techniques for syntactic analysis.</p> <p>C04 : Use algorithms at semantics level and resources of natural language data-corpora.</p> <p>C05 : Apply techniques for information extraction.</p>
72.	18MCAELO 5	<p>C01 : Input data, represent social networks as a graph and apply visualization techniques.</p> <p>C02 : Visualize network datasets.</p> <p>C03 : Perform different network measurements.</p> <p>C04 : Build and implement social network designs.</p> <p>C05 : Apply social network theory to social network datasets.</p>

## Course Outcomes (2020 Regulations)

### Course Outcomes

S.No	Course Code	Course Outcomes
1.	20MCA11	<p>CO1 : Apply the concept of system of linear equation to real time problems</p> <p>CO2 : Understand basic statistical concepts and measures.</p> <p>CO3 : Apply the concept of probability distribution and random variables to different problems and apply the principles of correlation and regression.</p> <p>CO4 : Analyse and solve problems using sampling theory.</p> <p>CO5 : Acquire sound knowledge of analysis in the time series and decision making through analysis of variance in the field of data analysis</p>
2.	20MCA12	<p>CO1 : Choose and design data structures such as array, linked list, stack, queue, trees and graphs to effectively model information in a problem.</p> <p>CO2 : Choose and apply operations like insertion, deletion, traversal and searching mechanism on various data structures relevant to a problem.</p> <p>CO3 : Judge efficiency trade-offs between data structures.</p> <p>CO4 : Apply standard algorithms for searching and sorting based on given problem.</p> <p>CO5 : Apply algorithm analysis techniques to evaluate performance of an algorithm.</p>
3.	20MCA13	<p>CO1 : Identify the components of RDMS software and its significance.</p> <p>CO2 : Analyze the data requirements and create conceptual design of the database using Entity Relationship model.</p> <p>CO3 : Identify functional dependencies and apply normalization techniques to optimize the data design.</p> <p>CO4 : Write SQL queries based on the functional requirements of any real world database applications.</p> <p>CO5 : Implement different concurrency control techniques in transactions and recovery mechanisms used in database.</p>
4.	20MCA14	<p>CO1 : Demonstrate the structure of operating system, batch programming, system calls and virtual machines</p> <p>CO2 : Demonstration of Kernel Management specific to concurrent process for Inter Process Communication systems</p> <p>CO3 : Estimate system performance through scheduling algorithms - FIFO, round robin, priority, shortest job first</p>

		<p>C04 : Recognize memory allocation and de-allocation for both static and dynamic storage</p> <p>C05 : Design and develop a simple File System using Disk and File System Management</p>
5.	20MCA15	<p>C01 : Choose applicable software life-cycle model to develop software for given customer need and justify choice with reference to complexity, cost and time.</p> <p>C02 : Determine software requirements based on customer need and develop industry standard Software Requirement Specification (SRS) document</p> <p>C03 : Construct models using functional and object oriented design principles, concepts and tools based on SRS document.</p> <p>C04 : Prepare suitable structural and behavioural analysis models based on SRS document.</p> <p>C05 : Formulate test cases and test data using white box and black box techniques to deliver defect free software</p>
6.	20MCA16	<p>C01 : Choose appropriate Data structures for implementing given scenario.</p> <p>C02 : Demonstrate the applications of Linked Lists, Stack, Circular Queue and Priority Queue.</p> <p>C03 : Design recursive algorithms and implement in real time application.</p> <p>C04 : Demonstrate various operations on Heap and Binary Search Tree.</p> <p>C05 : Compare various sorting and searching techniques in term of time complexity and space complexity</p>
7.	20MCA17	<p>C01 : Design the conceptual data model as Entity Relationship diagram and create the database using DDL statements for a given application</p> <p>C02 : Formulate simple DML SQL queries to retrieve the required data for real world applications</p> <p>C03 : Generate DML queries using Sub Queries, Joins, Group By, Order By and Aggregate functions to filter and aggregate the data of the real world applications</p> <p>C04 : Construct reusable PL/SQL blocks with Functions, Procedures, Packages, Triggers, Exception Handling, and Cursors as required by OLTP applications</p> <p>C05 : Develop a database project by constructing ER model, Creating Tables and write SQL and PL/SQL blocks using RDBMS software.</p>
8.	20MCA18	<p>C01 : Write, test, and debug simple Python programs using</p>

		<p>conditional and looping statements.</p> <p>C02 : Develop modular programs using functions.</p> <p>C03 : Represent compound data using strings, lists, tuples, and dictionaries.</p> <p>C04 : Perform numerical operations on large datasets.</p> <p>C05 : Apply suitable library function to analyze and classify the data.</p>
9.	20MCA19	<p>C01 : Develop Communication and Soft skills through self assesment to excel at work place.</p> <p>C02 : Apply intonation rules, Phonetic patterns and formulate appropriate speech patterns .</p> <p>C03 : Apply the rules of grammar viz., Parts of speech, Idioms, Phrasal Verbs, Concord, Cause and Effect, purpose and function and write a technical passage correctly.</p> <p>C04 : Summarize a technical text and write a process description.</p> <p>C05 : Plan, Structure and present a 15 minutes presentation on a technical topic.</p>
10.	20MCA21	<p>C01 : Apply various heuristic search strategies in optimal decision making.</p> <p>C02 : Understand uncertainty in real world situations.</p> <p>C03 : Employ first order logic for building knowledge base and demonstrate reasoning.</p> <p>C04 : Express different planning strategies to deal with problems.</p> <p>C05 : Describe and apply various knowledge representation techniques</p>
11.	20MCA22	<p>C01 : Design an object oriented software solution by discovering appropriate classes and objects and identifying attributes, behavior and hierarchy among the classes</p> <p>C02 : Write java programs by employing the object oriented constructs of inheritance and polymorphism for a given software requirement</p> <p>C03 : Organize the application programs into packages and prepare a deployable application for the given software solution</p> <p>C04 : Generate robust java applications for a given user requirement by employing applicable object oriented concepts and handling all possible exceptions</p> <p>C05 : Design and develop full stack web applications using React JS and Node JS</p>

12.	20MCA23	<p>C01 : Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure</p> <p>C02 : Describe various service delivery models of cloud computing architecture</p> <p>C03 : Deploy applications over commercial cloud computing infrastructures such as Amazon Web Services and Google AppEngine.</p> <p>C04 : Describe the virtualization technology behind the working of cloud computing.</p> <p>C05 : Identify security and privacy issues in cloud computing and devise appropriate security solutions for protecting cloud resources.</p>
13.	20MCA24	<p>C01 : Understand and use the concepts of Service-Oriented Architecture for building platform independent distributed applications.</p> <p>C02 : Design and develop simple to complex web services by analyzing the requirements of web applications.</p> <p>C03 : Apply the concepts of RESTful web services and create dynamic web applications</p> <p>C04 : Determine the security requirements of web services and incorporate them in building web applications.</p> <p>C05 : Examine the requirements of distributed applications, identify and justify the need for using web services.</p>
14.	20MCA25	<p>C01 : Design and implement heuristic search procedures.</p> <p>C02 : Develop constraint satisfaction problem solution.</p> <p>C03 : Design and implement solutions for classical Artificial Intelligence problems.</p> <p>C04 : Design and implement knowledge based system.</p> <p>C05 : Become familiar with use of Artificial Intelligence tools.</p>
15.	20MCA26	<p>C01 : Understanding Object oriented concepts and developing software modules.</p> <p>C02 : To develop effective GUI on Client side using Java Client and Server Side Technologies</p> <p>C03 : Write codes to handle the requests of client using JSP,</p> <p>C04 : Handle the backend processing from both client and server side.</p> <p>C05 : Choose a suitable development stack for the industry requirements.</p>
16.	20MCA27	<p>C01 : Generate ideas, Acquire right communication and interpersonal skills.</p> <p>C02 : Set career goals and formulate strategies by Prioritizing, Organizing and Scheduling for the required task.</p>

		<p>C03 : Project appropriate grooming and right etiquette in the corporate context.</p> <p>C04 : Prepare a job application letter with a Resume or C.V.</p> <p>C05 : Exhibit appropriate grooming and right etiquettes for Interviews and Group Discussion tasks.</p>
17.	20MCA28	<p>C01 : Analyze different domains, identify problems that require software solutions and justify.</p> <p>C02 : Choose appropriate problem solving techniques for the identified problem.</p> <p>C03 : Practice software engineering principles and programming skills in developing software solutions.</p> <p>C04 : Test the developed software to ensure compliance of requirements.</p> <p>C05 : Write the project report demonstrating the contribution and complete technical details</p>
18.	20MCA31	<p>C01 : Understand the basic principles of security and develop simple cryptosystems using classical ciphers</p> <p>C02 : Analyze the adequate basic security required by any computing system and apply cryptography algorithms to protect the confidentiality of information resources across networks</p> <p>C03 : Analyze security policies and best practices and apply suitable security technique to achieve integrity, and nonrepudiation of information</p> <p>C04 : Demonstrate different threats and vulnerabilities of network security and apply suitable security controls to protect internal and external networks</p> <p>C05 : Understand threats against various system components and choose a best technique to control the threat</p>
19.	20MCA32	<p>C01 : Recognize fundamental issues and challenges of machine learning : data, model selection, model complexity, supervised and unsupervised learning.</p> <p>C02 : Understand and apply Decision trees and Artificial Neural Networks.</p> <p>C03 : Distinguish the strength and weakness of Bayesian learning.</p> <p>C04 : Analyze and apply Instance based learning and rule based learning.</p> <p>C05 : Assess capability of Reinforcement learning and study its application</p>
20.	20MCA33	<p>C01 : Understand the classical crypto systems used for the confidential information exchange and use different</p>

		<p>ciphers in secure data transfer</p> <p>C02 : Demonstrate understanding of security best practices and techniques to preserve confidentiality of information at rest, and in Transit and apply suitable cryptographic algorithm to preserve the confidentiality of information</p> <p>C03 : Apply hash and message digest algorithms to preserve the integrity of information</p> <p>C04 : Apply standard digital signature scheme to verify the authenticity of information and use Steganography to hide secret messages</p> <p>C05 : Demonstrate the working of network security tools including Packet capturing and Intrusion Detection</p>
21.	20MCA34	<p>C01 : Introduce students the basic concepts and techniques of machine learning.</p> <p>C02 : Develop skills using recent machine learning software for solving practical problems.</p> <p>C03 : Gain experience of doing independent study and research in machine learning.</p> <p>C04 : Apply various classification and clustering techniques for problems.</p> <p>C05 : Design and development of game and traffic control system using reinforcement learning.</p>
22.	20MCAIT01	<p>C01 : Exposure to the industrial environment, recognize the requirement of the industry and cope up with the Industrial scenario.</p> <p>C02 : Recognize career paths taking into account their individual abilities and prepare a report about the work experience in industry</p> <p>C03 : Communicate effectively about the training through technical presentation.</p> <p>C04 : Develop their employability and start-up skills and to enhance the ability to engage in, life-long learning</p> <p>C05 : Develop individual confidence to handle various engineering assignments and ability to think strategically and expose themselves to acquire life skills to meet societal challenges</p>
23.	20MCA41	<p>C01 : Comprehensively demonstrate understanding of the software development processes and practices.</p> <p>C02 : Work to a professional standard in a specified role.</p> <p>C03 : Contribute effectively/co-operatively within a team.</p> <p>C04 : Exhibit industry-standards of professionalism in their work through knowledge or use of latest techniques and</p>

		<p>tools.</p> <p>C05 : Reflect on the work done and own role and present their work through a report and formal viva</p>
24.	20MCAE101	<p>C01 : Employ point- line and circle scan conversion algorithms for drawing graphical object.</p> <p>C02 : Employ fill area scan conversion algorithms for drawing of graphical objects.</p> <p>C03 : Construct a world coordinate scene from its constituent elements (defined in their local coordinate systems) by applying geometric transformations on the constituent elements.</p> <p>C04 : Determine the clipping operations required to change from the current display to a new display- when interactive operations through keyboard or mouse are performed.</p> <p>C05 : Analyse the performance of image- video- audio- text and graphics data compression techniques.</p>
25.	20MCAE102	<p>C01 : Analyze the background processes involved in queries and determine their impact on database operations and design.</p> <p>C02 : Analyze different methods and techniques for parallel and distributed query processing and apply appropriate algorithms for optimizing query execution.</p> <p>C03 : Demonstrate the usage of different architecture and design strategies for distributed and parallel databases.</p> <p>C04 : Apply the concepts of SQL for enterprise applications.</p> <p>C05 : Design data models for advanced applications using object oriented and other databases</p>
26.	20MCAE103	<p>C01 : Analyze the advantages and disadvantages of various models for a distributed system</p> <p>C02 : Compare Remote Procedure Call and Remote Method Invocation from the perspective of developing distributed applications</p> <p>C03 : Describe the role of distributed Operating System and distributed File System in developing distributed systems</p> <p>C04 : Design the process of discovering and locating distributed objects using Naming and Directory services</p> <p>C05 : Demonstrate the concurrency control mechanism for distributed transactions</p>
27.	20MCAE104	<p>C01 : Understand the basics of distributed systems and programming models.</p> <p>C02 : Examine grid computing architecture and its components.</p>

		<p>C03 : Apply concepts of grid computing and build distributed applications.</p> <p>C04 : Access and Identify the need for cluster computing.</p> <p>C05 : Design cluster computing based solutions for real world problems by incorporating load balancing.</p>
28.	20MCAE105	<p>C01 : Understand general concepts of Internet of Things (IoT)</p> <p>C02 : Recognize various devices and challenges</p> <p>C03 : Apply design concept to IoT solutions</p> <p>C04 : Analyze various M2M and IoT architectures</p> <p>C05 : Develop IoT solutions using sensors, actuators and Devices</p>
29.	20MCAE106	<p>C01 : Analyze the problem to ascertain the type of software measurement.</p> <p>C02 : Apply selected statistical methods and enlist the findings of analysis.</p> <p>C03 : Design and tailor the selected metric to match the information reliabilities need.</p> <p>C04 : Determine a plan to decide what data to collect and who should collect it.</p> <p>C05 : Interpret and communicate the metric results</p>
30.	20MCAE107	<p>C01 : Ascertain the need of software development methodologies with agility and self adaptability features to develop the software which meets the user needs.</p> <p>C02 : Compare the practices followed in different agile methodologies and choose the suitable methodology for a given project</p> <p>C03 : Synthesize the various agile methodology practices to produce a methodology for a project</p> <p>C04 : Develop the system by employing test first programming concept using Junit framework</p> <p>C05 : Develop a simple application using Scrum or XP methodology</p>
31.	20MCAE108	<p>C01 : Ascertain the need for Software Architecture and its features to develop software that meets user needs.</p> <p>C02 : Choose the suitable architectural style for a given project</p> <p>C03 : Synthesize the various architectural styles to produce a quality project</p> <p>C04 : Develop system by employing Design Patterns.</p> <p>C05 : Develop a simple application using Software Architecture and Design Pattern</p>
32.	20MCAE109	<p>C01 : Understand the architecture of robots by learning paradigms and intelligence.</p>

		<p>C02 : Apply the Forward and Inverse Kinematics of manipulators and understand the dynamics in locomotion control and trajectory generation.</p> <p>C03 : Program an application for industrial robots.</p> <p>C04 : Synthesize the Machine Intelligence in robots by studying the functions of industrial manipulators using AI approach.</p> <p>C05 : Understand the automation in robotics by using drive system for gripper movement.</p>
33.	20MCAE110	<p>C01 : Understand the basic concepts of super-computing and parallel programming architecture</p> <p>C02 : Identify the difference between serial and parallel programming needs to solve real-time problems.</p> <p>C03 : Demonstrate the ability to use GPUs for parallel programming to solve compute intensive tasks.</p> <p>C04 : Identify CUDA architecture and its components.</p> <p>C05 : Apply parallel programming methods and solve problems using CUDA platform</p>
34.	20MCAE111	<p>C01 : Describe different modalities and current techniques in image processing</p> <p>C02 : Provide mathematical foundations for digital manipulation of image acquisition, pre-processing, enhancement, segmentation and compression.</p> <p>C03 : Apply image processing techniques in both the spatial and frequency (Fourier) domains</p> <p>C04 : Learn different feature extraction techniques for image analysis and recognition.</p> <p>C05 : Develop and compare various Image Compression and Decompression Techniques.</p>
35.	20MCAE112	<p>C01 : Understand the basics of distributed environment and decentralization.</p> <p>C02 : Describe the fundamentals of Blockchain.</p> <p>C03 : Analyze the working principles of Bitcoin.</p> <p>C04 : Develop Cryptography algorithms and protect Cryptocurrencies.</p> <p>C05 : Examine the development platform ethereum and Hyperledger</p>
36.	20MCAE113	<p>C01 : Learn to build modern browser-based applications that take advantage of stronger client platforms and more predictable bandwidth.</p> <p>C02 : Learn the SPA design approach</p> <p>C03 : Explore new techniques like structured java scripts and</p>

		<p>responsive design</p> <p>C04 : Know how to capitalize trends like server side JavaScript and NoSQL data stores</p> <p>C05 : Develop frameworks that makes JavaScript more manageable and testable as a first class language.</p>
37.	20MCAE114	<p>C01 : Assess the impact of digital technology on the practice of marketing.</p> <p>C02 : Analyse the use of different forms of digital marketing in the development of an online presence.</p> <p>C03 : Develop a plan for marketing a product of business online.</p> <p>C04 : Integrate social media tools into a marketing communications strategy.</p> <p>C05 : Use a publishing platform to build a web presence with integrated data collection and links to social media</p>
38.	20MCAE115	<p>C01 : Gain knowledge of how a project will be broken down into stages and what each stage contributes to the project</p> <p>C02 : Select appropriate techniques for use in the stages of a project</p> <p>C03 : Justify the appropriateness of these techniques- and apply them to practical situations</p> <p>C04 : Know the limitations of the project approach in developing information/software systems</p> <p>C05 : Test and apply metrics on the developed software to ensure compliance of requirements.</p>
39.	20MCAE116	<p>C01 : Implement fundamental image processing techniques required for computer vision.</p> <p>C02 : Perform shape analysis and implement boundary tracking techniques.</p> <p>C03 : Apply Hough Transform for line, circle, and ellipse detections.</p> <p>C04 : Apply 3D vision techniques and implement motion related techniques.</p> <p>C05 : Develop applications using computer vision techniques</p>
40.	20MCAE117	<p>C01 : Analyze different approaches to test software, and select applicable techniques for different situations and projects.</p> <p>C02 : Prepare a software quality plan for a software project considering process evaluation models including issues related to change management, configuration management, verification and validation, and measurement.</p> <p>C03 : Design test plans, create test procedures and design</p>

		<p>measures to evaluate result of tests.</p> <p>C04 : Apply black box and white box testing techniques at various testing levels for given requirements to achieve adequacy criteria.</p> <p>C05 : Use standards, models and techniques aimed at achieving quality assurance in different software development environments</p>
41.	20MCAE118	<p>C01 : Know about the professional management and implementation of Open Source Technologies</p> <p>C02 : Analyse the differential combination of new technologies with the matured one</p> <p>C03 : Decide on the boundaries of business which the web changed from building the business case to doing hands-on experimentation</p> <p>C04 : Self teach the issues faced in transitioning to the new technologies, ranging from business to social concern.</p> <p>C05 : Understand roles for open source software in organization.</p>
42.	20MCAE119	<p>C01 : Make computing available as a utility under the internet.</p> <p>C02 : Understand the fundamentals of enterprise architecture and enterprise computing.</p> <p>C03 : Implement cloud programming paradigms like MapReduce.</p> <p>C04 : Describe the emerging development paradigms and technologies and discuss how these will change the way the enterprise applications should be architected.</p> <p>C05 : Understand the benefits of open source technologies on enterprise computing</p>
43.	20MCAE201	<p>C01 : Outline the definitions, concepts and enabling technologies of data analytics.</p> <p>C02 : Analyze different statistical analysis techniques to be applied on different types of datasets.</p> <p>C03 : Develop regression models using R for a given dataset.</p> <p>C04 : Apply text analysis methods to analyze unstructured data.</p> <p>C05 : Create solutions for real world business problems and effectively present results using data visualization techniques.</p>
44.	20MCAE202	<p>C01 : Understand algorithms and techniques for information retrieval.</p> <p>C02 : Design a search engine or any text retrieval system.</p> <p>C03 : Apply data mining techniques and quantitative evaluation methods for IR systems.</p>

		<p>C04 : Develop applications with retrieval capabilities.</p> <p>C05 : Combine aspects of information visualization and mining for information retrieval and web information retrieval</p>
45.	20MCAE203	<p>C01 : Build single and multi-node Hadoop clusters on Linux or Windows platform</p> <p>C02 : Use Hadoop file system commands to load and execute programs on it.</p> <p>C03 : Write map-reduce programs for data intensive applications and execute them on the Hadoop platform.</p> <p>C04 : Use NoSQL databases like MongoDB in data processing applications.</p> <p>C05 : Choose appropriate big data technologies to analyse big data for a given analytic requirement.</p>
46.	20MCAE204	<p>C01 : Examine a given dataset identify the analysis goals and providing data mining solutions to achieve those goals.</p> <p>C02 : Choose proper pre-processing techniques by studying the characteristics of the attributes of the dataset and prepare it for data mining.</p> <p>C03 : Apply association rule mining techniques such as Apriori and FP-Tree to a given dataset and generate association rules from it.</p> <p>C04 : Analyze the suitability of classification (Decision Tree) and clustering algorithms(K-Means and K-Medoids) for a given data analysis requirement.</p> <p>C05 : Mine hidden patterns from the dataset after applying pre-processing techniques and derive inference from the results of mining.</p>
47.	20MCAE205	<p>C01 : Understand core algorithms and data structures used in NLP</p> <p>C02 : Utilize corpora and annotations added to them</p> <p>C03 : Build statistical NLP components such as n-gram language models, text classifiers and Parts-of-speech taggers, that learns from such corpora</p> <p>C04 : Evaluate the merits of different machine learning methods for given NLP tasks</p> <p>C05 : Appreciate the relationship between linguistic representations and computational applications</p>
48.	20MCAE206	<p>C01 : Understand concept of semantic web and related applications.</p> <p>C02 : Represent knowledge using ontology.</p> <p>C03 : Model social network data.</p> <p>C04 : Understand importance of communities in social network.</p>

		C05 : Apply techniques for visualization of social networks.
49.	20MCAE301	<p>C01 : Identify the components required to build different types of networks and have an understanding of network models.</p> <p>C02 : Analyze the layered functionality and data communication mechanisms used between nodes.</p> <p>C03 : Identify the protocols involved at the various layers and demonstrate the role of each protocol.</p> <p>C04 : Analyze and describe the working principles of Internet.</p> <p>C05 : Apply various routing protocols, demonstrate the best routing between nodes and describe the network functionalities for a given application.</p>
50.	20MCAE302	<p>C01 : Illustrate the working principles of link layer and network layer protocols used for data communication in the Internet.</p> <p>C02 : Determine the suitability of User Datagram Protocol for the given application in terms of reliability and Performance.</p> <p>C03 : Understand and experiment the working of Transmission Control Protocol for the given application based on its requirements.</p> <p>C04 : Analyze the requirements for monitoring and controlling a network using Simple Network Management Protocol and the Management Information Base.</p> <p>C05 : Develop TCP and UDP based socket programs for the given client server communication scenario</p>
51.	20MCAE303	<p>C01 : Describe wireless and mobile computing systems and analyze the architecture- functions and emerging techniques in GSM</p> <p>C02 : Understand the issues and techniques used in the design of MACfor Wireless communication.</p> <p>C03 : Explain the structure and components for Mobile IP and Mobility Management</p> <p>C04 : Describe the types and functionalities of transport and application layer services for wireless communication</p> <p>C05 : Develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.</p>
52.	20MCAE304	<p>C01 : Study about wireless network basics, architecture, protocol stack and standards.</p> <p>C02 : Understand the working of wireless medium access control layer and network layer.</p>

		<p>C03 : Design and implement wireless network environment using wireless network protocols and standards.</p> <p>C04 : Analyze different routing protocols in mobile ad-hoc network.</p> <p>C05 : Conversant with advanced wireless networks 3G, 4G and 5G and their architecture.</p>
53.	20MCAE305	<p>C01 : Describe unique issues in ad-hoc networks and MAC protocols and their classifications</p> <p>C02 : Discuss challenges in designing routing and transport protocols for ad-hoc networks</p> <p>C03 : Demonstrate familiarity with common wireless sensor node architecture and the organization of MAC protocols developed for WSN.</p> <p>C04 : Demonstrate knowledge of routing in WSN and to analyze and classify wireless mesh networks.</p> <p>C05 : Develop simple routing solutions for ad-hoc- WSN and mesh networks.</p>
54.	20MCAE401	<p>C01 : Given a case study, analyze the behavior of the individual.</p> <p>C02 : Given a case study, analyze the behavioral pattern of group interaction in organization</p> <p>C03 : Given a scenario in an organization assess the attitude and personality of the individuals in the organization.</p> <p>C04 : Given a business problem form groups and finds a solution to the problem.</p> <p>C05 : Given a problem in an organization, apply emotional intelligence and solve the problem</p>
55.	20MCAE402	<p>C01 : Describe the principles of management.</p> <p>C02 : Prepare a decision tree for a given statement.</p> <p>C03 : Given a business plan, specify the management functions (planning- organizing- controlling and evaluating)</p> <p>C04 : Construct the organizational chart for given company.</p> <p>C05 : Prepare a flow chart of the selection process of a given company.</p>
56.	20MCAE403	<p>C01 : Prepare books of accounts and verify correctness using trial balance, for any business organization.</p> <p>C02 : Prepare statements of final accounts to ascertain the profit,forany trading or manufacturing organization.</p> <p>C03 : Perform cost estimation and determine the optimum cost/price/profit for a firm using Cost Sheet, CVP analysis and Marginal Costing Techniques.</p> <p>C04 : Prepare financial statements using ratio analysis, budgeting, working capital management, capital</p>

		<p>budgeting and budgetary control techniques and present facts to assist in strategic decision making, given a set of investment options for a business.</p> <p>C05 : Develop software solutions to automate a given accounting, costing or financial process, using MS-Excel</p>
57.	20MCAE404	<p>C01 : Specify Infrastructural requirements &amp; Business models for an e-commerce start up. (From the perspective of Indian Businesses)</p> <p>C02 : Analyze different types of e marketing and e advertising strategies and e-payment alternatives commonly used in the industry and summarize the relative merits in Indian socio economic scenario.</p> <p>C03 : Discuss trends in CRM- SCM and Knowledge Management using web technologies and point out the suitable adaptations for a medium scale e-commerce firm in India.</p> <p>C04 : Appraise the impact of different types of mobile and wireless technologies on success of e- commerce in India.</p> <p>C05 : Understand ERP and EDI technologies can transform the Indian Business environment into paperless, cashless, easy-to-manage and regulated, with the use of cloud and open source technologies.</p>
58.	20MCAE405	<p>C01 : Critically discuss different theories and theoretical perspectives in leadership - negotiation and decision making.</p> <p>C02 : Evaluate models to describe how leaders are perceived (leadership style)-analyse a leader's decision-making and role in negotiations.</p> <p>C03 : Analyse how decision-making and strategies in negotiations affect a leader's perception</p> <p>C04 : Use decision making tools to quantitatively analyse its impacts in a given situation</p> <p>C05 : Apply programmed and non-programmed decisions to effectively manage uncertainty</p>
59.	20MCAE406	<p>C01 : Highlight the characteristics of a successful entrepreneur.</p> <p>C02: Understand the role of entrepreneurship in the economic development of a country.</p> <p>C03 : Formulate the business plans for an efficient and successful \ business.</p> <p>C04 : Justify the need for developing rural entrepreneurship and agriprenurship in India.</p> <p>C05 : State the economic factors influencing the emergence and development in country.</p>

60.	20MCAE407	<p>C01 : Predict the values of biodiversity for the development</p> <p>C02 : Design the methods for the prevention of environmental pollution and solid waste management.</p> <p>C03 : Illustrate the use of alternate energy resources for growing energy needs</p> <p>C04 : Classify the environmental segments, the causes for its deterioration, the measure taken for its prevention and the need for sustainable development.</p> <p>C05 : Identify the threats to environment, social issues related to it, the necessity for environmental legislation, sustainable development and the applications of bio technology and green chemistry for environmental protection.</p>
61.	20MCAEL01	<p>C01 : Use the components of Android development environment for mobile application development</p> <p>C02 : Design GUI forms using layouts, views, event handling, notifications and content providers in Android studio.</p> <p>C03 : Implement database applications using SQLite and perform CRUD operations</p> <p>C04 : Develop mobile applications that make use of camera and media player in Android.</p> <p>C05 : Use location based services, network services and graphics to develop innovative mobile apps</p>
62.	20MCAEL02	<p>C01 : Design graphical primitives using algorithms</p> <p>C02 : Develop 2D Transformations.</p> <p>C03 : Design interactive graphics applications.</p> <p>C04 : Design objects and layers for scene in animation.</p> <p>C05 : Develop animated application software.</p>
63.	20MCAEL03	<p>C01 : Choose the required sensor and perform calibration, for a given requirement.</p> <p>C02 : Devise interface circuit for connecting a chosen sensor to Galileo board.</p> <p>C03 : Develop software for Galileo board to interact with the sensor to meet requirements.</p> <p>C04 : Develop software to interact (send/receive data) with Web/Application server located in the Internet.</p> <p>C05 : Use data analytics tool to analyze the data collected and present the report to the end user</p>
64.	20MCAEL04	<p>C01 : Understand the basics in R programming in terms of constructs, control statements, string functions.</p> <p>C02 : Able to perform different exploratory analysis for the real time dataset.</p>

		<p>C03 : Identify and apply appropriate regression models for the given dataset.</p> <p>C04 : Apply text analysis methods to analyze unstructured data.</p> <p>C05 : Represent the analysis results using different visualization methods such as charts, tables etc.</p>
65.	20MCAEL05	<p>C01 : Learn to use open source data mining tools such as Weka and/Rapidminer and build data mining applications using these tools.</p> <p>C02 : Select appropriate data pre-processing techniques to be applied on standard datasets various domains such as healthcare, finance, insurance etc and prepare the data for the mining process based on the analysis goal.</p> <p>C03 : Apply association rule mining techniques to derive useful and new pattern information from the given datasets.</p> <p>C04 : Apply classification algorithms to classify a given dataset and derive useful and new insights from the dataset.</p> <p>C05 : Represent the analysis results using different visualization methods such as charts, graphs etc.</p>
66.	20MCAEL06	<p>C01 : Learn the basics of CUDA programming.</p> <p>C02 : Implement data transfer from host to device and vice-versa.</p> <p>C03 : Develop CUDA code to perform operations on large arrays.</p> <p>C04 : Implement the concepts of shared memory both static and dynamic</p> <p>C05 : Develop parallel programming solutions for small real world applications using CUDA/GPU</p>
67.	20MCAEL07	<p>C01 : Implement the mathematical transforms necessary for image processing.</p> <p>C02 : Apply various enhancement and segmentation techniques.</p> <p>C03 : Apply image restoration process on different noises using filters.</p> <p>C04 : Execute various transforms and filtering on any digital image.</p> <p>C05 : Solve real life problems using image processing.</p>
68.	20MCAEL08	<p>C01 : Build a robust framework to support daily development needs</p> <p>C02 : Create dynamic web sites and web applications</p> <p>C03 : Create data models using MongoDB and ExpressDB</p> <p>C04 : Build components and bind data to it</p> <p>C05 : Develop single page applications with the front end</p>

		facilities in the stack
69.	20MCAEL09	<p>C01 : Apply basic algorithms in the area of Natural Language Processing.</p> <p>C02 : Perform morphological analysis on text.</p> <p>C03 : Apply techniques for syntactic analysis.</p> <p>C04 : Use algorithms at semantics level and resources of natural language data-corpora.</p> <p>C05 : Apply techniques for information extraction</p>
70.	20MCAEL10	<p>C01 : Input data, represent social networks as a graph and apply visualization techniques.</p> <p>C02 : Visualize network datasets.</p> <p>C03 : Perform different network measurements.</p> <p>C04 : Build and implement social network designs.</p> <p>C05 : Apply social network theory to social network datasets</p>
71.	20MCAEL11	<p>C01 : Understand the key protocols that support the communication.</p> <p>C02 : Develop and implement connection-oriented and connection-less communication using Socket API</p> <p>C03 : Develop and implement concurrent and iterative servers and analyze their functionality</p> <p>C04 : Apply advanced programming techniques such as Broadcasting, Multicasting and networking between client and server.</p> <p>C05 : Develop and implement simple network applications using NS-2 for a given set of requirements and demonstrate its working</p>
72.	20MCAEL12	<p>C01 : Generate market context with practical needs of digital marketing.</p> <p>C02 : Develop conversational interfaces with customers using connection oriented/connectionless services.</p> <p>C03 : Analyse a web site and its traffic using tools</p> <p>C04 : Understand the methods of optimizing the website for search engines.</p> <p>C05 : Know the improved latest technologies for efficient marketing</p>

## **B.Tech. Chemical Engineering**

### **2019 Regulations**

#### **PROGRAMME OUTCOMES (POs)**

1. Apply knowledge of mathematics, physical science and chemical engineering fundamentals to solve complex engineering problems.
2. Identify and analyze chemical engineering problems to improve the efficiency of processes and quality of products in chemical industry.
3. Design innovative process for complex chemical engineering systems and provide solutions to meet specified needs with appropriate consideration for public health & safety, culture, society and the environment.
4. Conduct investigations using research methodology, analysis and interpretation of results to derive scientifically sound conclusions.
5. To apply appropriate techniques and engineering software / tools for design & analysis of the process.
6. Apply contextual knowledge in designing systems, components or processes to meet societal needs in the field of chemical engineering.
7. Demonstrate professional skills and contextual reasoning to assess environmental & societal issues for sustainable development.
8. Apply ethical principles, commit to professional ethics and responsibilities, norms of practices.
9. Work effectively as an individual, as a member / leader in diverse teams and in multidisciplinary environments.
10. Communicate information and able to write technical reports & presentations.
11. Demonstrate and apply engineering & management principles in their own / team projects in multidisciplinary environment.
12. Recognize the need for, and have the ability to engage in independent and lifelong learning broadest context of technological change.

#### **PROGRAMME SPECIFIC OUTCOMES (PSOs)**

1. Understand and apply working knowledge of chemical engineering principles and applications.
2. Implement the inter-perceptual skills of individuals in technical profession.

**Course Outcomes:**

<b>Course Code</b>	<b>Course Outcome</b>
19CH35 CHEMICAL PROCESS CALCULATIONS	CO1: Apply the principles of dimensional homogeneity to convert one form of unit to other equivalent forms in CGS, FPS, MKS and SI unit systems and apply fundamental gas laws to solve ideal gas problems.
	CO2: Calculate the composition of a mixture in terms of mole fractions from a given composition expressed in terms of mass fractions or vice versa.
	CO3: Compute the concentration, degree of saturation and dew point of vapour - gas mixture at the given temperature and pressure using humidity chart.
	CO4: Formulate steady state material balance for the unit operations such as distillation, evaporation, mixing, extraction, drying and crystallization processes with recycle, by-pass and purge.
	CO5 : Practice the combined steady state material and Energy balance for simple processes like distillation, evaporation and combustion.
19CH42 MECHANICAL OPERATIONS	CO1: Select the appropriate size reduction equipment and analyze the particle size distribution in the feed and product.
	CO2: Identify suitable storage, transportation and recovery methods for various types of solids.
	CO3: Design the different type of agitators and mixers used in chemical industries and compare the same.
	CO4: Apply the basic principles of settling and sedimentation for the separation of different type of solid particles.
	CO5: Understand and analyse the working principles of industrial filters, centrifuges and membrane filters.
19CH43 CHEMICAL REACTION ENGINEERING – I	CO1: Formulate the rate equation from the stoichiometry and reaction mechanism for elementary and non-elementary reactions and determine the effect of temperature on the rate of reaction based on Arrhenius, Collision and Transition State Theories.
	CO2: Analyze kinetic data and determine the components of the rate equation (reaction order and specific reaction rate) for homogeneous single or multiple reactions using differential and integral method of analysis.

	<p>CO3: Design batch, plug flow and continuous stirred tank reactors and choose the appropriate reactor or reactor combination based on qualitative and quantitative analysis for the specific reaction conditions.</p>
	<p>CO4: Predict the effect of pressure and temperature on adiabatic and non-adiabatic operation</p>
	<p>CO5: Compute precisely the moments of RTD using pulse tracer test data for the real reactors and estimate extent of non-ideality of real reactors based on the segregation, tank in series and dispersion models using pulse tracer test or conversion data.</p>
19CH44 HEAT TRANSFER	<p>CO1: Solve one-dimensional steady state heat conduction problems for the rectangular, cylindrical and spherical co-ordinate systems.</p>
	<p>CO2: Analyze the convection heat-transfer problems for laminar and turbulent flows in internal and external configurations by understanding the basics of the boundary layer theory.</p>
	<p>CO3: Estimate heat exchanger design parameters like heat transfer area and overall heat transfer coefficient using LMTD and effectiveness - NTU method.</p>
	<p>CO4: Estimate the heat transfer co-efficient for phase change operations using empirical correlations.</p>
	<p>CO5: Apply fundamental laws of radiation to determine the heat transfer rate between surfaces and apply the principles of evaporation to precisely calculate the energy requirement for single and multiple effect evaporators.</p>
19CH45 MASS TRANSFER – I	<p>CO1: Estimate the mass transfer flux for molecular diffusion in fluids and measurement of diffusivity.</p>
	<p>CO2: Analyze mass transfer theories to predict the mass transfer coefficients, develop the analogy between momentum, heat and mass transfer.</p>
	<p>CO3: Compute the height of packing or number of plates required for the given separation by graphical and analytical method for absorption.</p>
	<p>CO4: Analyze flash, differential and steam distillation methods and calculate the vapour-liquid equilibria.</p>
	<p>CO5: Determine the number of ideal plates using Ponchon-savarit and McCabe-thiele method and categorize azeotropic and extractive distillation.</p>

19CH51 NUMERICAL METHODS IN CHEMICAL ENGINEERING	CO1: To solve systems of algebraic equation using various numerical schemes and to develop programming code using MATLAB and EXCEL.
	CO2: To Solve nonlinear algebraic equation using open and bracketing type numerical methods
	CO3: To practice numerical integration using trapezoidal, Simpsons techniques for chemical problems.
	CO4: To solve single ODE and Simultaneous ODEs using various numerical schemes.
	CO5: To formulate and solve PDEs for real time chemical Engineering Problems.
19CH52 CHEMICAL REACTION ENGINEERING – II	CO1: Develop rate kinetic for catalytic reaction and catalyst deactivation.
	CO2: Analyze external diffusion Effects on heterogeneous reactions.
	CO3: Solve the problem based on diffusion and reaction in porous catalysts
	CO4: Develop the reaction kinetics for a non-catalytic reaction with chemical reaction and mass transfer controlling regime and design non-catalytic reaction system
	CO5: To explain the underlying principles in multiphase reactors kinetics.
19CH53 - MASS TRANSFER – II	CO1: Determine the number of stages and recovery efficiency for solid-liquid and liquid-liquid extraction processes
	CO2: Calculate the quantity of adsorbent required for stage-wise operations and illustrate the types of adsorption, adsorption isotherms and ion-exchange process.
	CO3: Determine the properties of air-water system using psychrometric chart and review the operational features of cooling towers.
	CO4: Analyse the applications of dryers and calculate the time of drying from rate of drying curve.
	CO5: Compute the yield of crystals and select the crystallizer by revising the working features.

19CH61 PROCESS DYNAMICS AND CONTROL	CO1: Apply conservation principles in order to model the dynamics of simple process systems to develop first, second and multi capacity transfer functions.
	CO2: Analyse closed loop stability systems by applying transient responses and also to test the stability of the control system by Root Locus, Routh and Bode methods.
	CO3: Discuss P, PI, PD, PID controller actions and its transfer functions. Practice blocks diagram development for closed loop systems by applying transient responses to find the process error.
	CO4: Devise control strategies for the control of mass and heat transfer equipment using advanced controllers.
	CO5: Discuss digital process controllers and the hardware components of its direct digital controllers and its applications.
19CH71 - TRANSPORT PHENOMENA	CO1: Determine the interrelationship between the molecular, microscopic and macroscopic descriptions of transport processes and compare the various coordinate systems to formulate Continuity, Navier-Stokes and Euler equations.
	CO2: Apply shell balance technique to formulate the differential equation of change for steady and unsteady-state flows
	CO3: Analyse the problems involving steady state and unsteady state heat conduction in simple geometries and obtain numerical solutions for the problems.
	CO4: Develop microscopic and macroscopic energy balances for steady and unsteady energy transport processes
	CO5: Apply the individual and overall mass transfer coefficient in multi-phase systems for design applications.
19CH72 PROCESS ECONOMICS AND TECHNOLOGY MANAGEMENT	CO1 : Practice various depreciation methods and its uses in industries for the recovery of plant cost
	CO2 : Assess the various financial ratios by taking the real time data's of the industries and comment the stability of the financial statements
	CO3 : Practice various Process technology cost calculations and its feasibility analysis.
	CO4 : Outline the various management principles and organization types practiced in the organizations

	CO5 : Discuss the production planning control methods in industries and also role of control charts in production for the quality control.



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GOVERNMENT AIDED AUTONOMOUS INSTITUTION  
APPROVED BY AICTE AFFILIATED TO ANNA UNIVERSITY,  
CHENNAI. DEPARTMENT OF COMPUTING  
Department of AI and DS**

**PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

**PEO1:** Build next generation of highly skilled graduates equipped with a strong knowledge in Artificial intelligence (AI) and Data Science (DS) for creating innovative solutions to society's pressing challenges.

**PEO2:** Create engineers in addressing wide variety of challenges in managing and analysing different nature of data and able to use and develop software systems in complex data intensive and AI- related applications.

**PEO3:** Demonstrate professionalism in graduates and reflect on personal performance and self-management processes as a means of continued professional development and lifelong learning in areas of emerging technologies.

## PROGRAM OUTCOMES (POs)

<b>PO1:</b>	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and Artificial Intelligence and Data Science basics to the solution of complex engineering problems.
<b>PO2:</b>	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
<b>PO3:</b>	<b>Design/development of solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
<b>PO4</b>	<b>Conduct investigations of complex problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
<b>PO5</b>	<b>Modern tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
<b>PO6</b>	<b>The engineer and society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
<b>PO7</b>	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
<b>PO8</b>	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
<b>PO9</b>	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO10</b>	<b>Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
<b>PO11</b>	<b>Project management and finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as

	a member and leader in a team, to manage projects and in multidisciplinary environments.
<b>PO12</b>	<b>Life-long learning:</b> Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

### **PROGRAMME SPECIFIC OUTCOMES (PSO)**

1. Graduates should be able to evolve AI based efficient domain specific processes for effective decision making in several domains such as business and governance domains.
2. Graduates should be able to arrive at actionable Fore sight, Insight , hind sight from data for solving business and engineering problems
3. Graduates should be able to create, select and apply the theoretical knowledge of AI and Data Analytics along with practical industrial tools and techniques to manage and solve societal problems

#### **SEMESTER 1**

##### **21FYM14 - MATRICES AND CALCULUS**

CO1: Incorporate suitable methods of eigenvalues of matrices and implement the same for applications in software programs.

CO2: Understand maxima and minima concepts and implement in programming problems.

CO3: Solve multiple integrals and apply to find area and volume of surfaces and solids.

CO4: Provide the strong background of vector calculus for the study of science and technological problems.

CO5: Assimilate the efficient use of ordinary differential equations in software problems

##### **21FYE11 - TECHNICAL ENGLISH**

CO1: Compose appropriate dialogues, construct descriptive paragraphs and review, for a given communication context.

CO2: Categorize the barriers to communication and formulate solutions for a communication context. Generate functional expressions and construct dialogues, for a given situation, like introducing oneself, asking questions, disagreeing, expressing preferences, asking for and giving directions.

CO3: Specify appropriate responses and construct a summary, for a given short conversations and monologues for listening.

CO4: Interpret the given technical graphical representation and compose passages. Summarize and paraphrase technical texts in about 250 to 300 words.

CO5: Apply the rules of the grammar viz., word formation, Verbs, Tenses, Question Tags, Prepositions, Articles, Conjunctions, Concord, Idiomatic Expressions, One Word Substitutes, Homophones and Homonyms, Linking words, adjectives and degrees of comparison, use appropriate patterns in the given sentence.

### **21FYP13 ENGINEERING PHYSICS**

CO1: The students will gain knowledge and understanding of lasers and optical fibers

CO2: The students will have a conceptual understanding about quantum mechanics and acquire basic knowledge about nano materials

CO3: The students will be able to demonstrate competency and understanding of the electrical properties of conductors and dielectrics

### **21FYC11 - ENGINEERING CHEMISTRY**

CO1: The students will be able to calculate the calorific value of different types of ules and apply the same for suitable applications

CO2: The students will be conversant with the principles and implication of corrosion and its applications

CO3: The students will be able to familiarize with various types of material analysis

CO4: The students will be able to synthesize the nano materials of different size and shapes using different synthesis technique and apply the same for the energy conversion and storage devices

### **21CS11 C PROGRAMMING**

CO1: Fundamental knowledge in problem solving, designing algorithms and representation through flowcharts

CO2: Develop simple programs using decision making statements and looping constructs

CO3: Handling series of data items through arrays and pointers

CO4: Understand and practice modularization of the given problem using functions.

CO5: Ability to solve real-world problems involving collection of data items through structures and files.

## **21CSL11 - C PROGRAMMING LABORATORY**

CO1: Ability to write, compile and execute C programs

CO2: Develop simple programs using decision making statements and looping constructs

CO3: Practice operations on arrays, strings and pointers

CO4: Practice modularization of the given problem using functions

CO5: Write programs using structures and files.

## **21PL11 - PHYSICS LABORATORY – I**

CO1: Will be able to gain a fundamental understanding of the apparatus used in the experiments and recognize how observation, experiment and theory work together

## **21CL11 - CHEMISTRY LABORATORY – I**

CO1: By the estimation of dissolved oxygen present in water, the students will be able to appreciate how oxygen causes corrosion of boiler materials Students can able to handle analytical tools such as conductormeter and pHmeter

CO2: Students will gain an understanding of different types of volumetric titration

## **21MEL12 – ENGINEERING PRACTICES LABORATORY**

CO1: Understand various engineering practices like carpentry, fitting, sheet metal, plumbing and electrical wiring and relevant tools.

CO2: Identify and rectify minor electrical problems at home and office.

CO3: Implement the skills acquired during their project work

CO4: Develop their hand-eye coordination capabilities.

## **21FYEL11 - EMPLOYABILITY SKILLS**

CO1: Solve timed objective question on logical reasoning and verbal ability.

CO2: Generate ideas and speak confidently, for a given specific speaking task on topics like describing a picture, movie reviews, storytelling, and extempore.

CO3: Use appropriate functional expressions, for a given social situation viz., greeting, thanking, congratulating, apologizing and giving directions.

CO4: Produce language structures accurately and fluently, for a given 2 to5 minutes speaking activity like Extempore and Debate. Prepare a power point presentation for 15 minutes, for a given technical topic.

CO5: Specify appropriate responses and construct a summary for given short conversations and monologues for listening. Construct dialogues for a given social scenario, interpret the given graphic information and write creative paragraphs.



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GOVERNMENT AIDED AUTONOMOUS INSTITUTION APPROVED BY AICTE

AFFILIATED TO ANNA UNIVERSITY, CHENNAI.

## DEPARTMENT OF COMPUTING

(Artificial Intelligence and Machine Learning)

### COURSE OUTCOMES

#### SEMESTER-1

##### 19MAM11 – TECHNICAL ENGLISH

CO1: Given a social context compose appropriate dialogues using functional words, Construct Descriptive paragraphs using sequencing words and unity of thought

CO2: Given a communication context, categorize the barriers to communication and formulate solutions. Plan and present a 15-minute presentation on a technical topic.

CO3: Given short conversations and monologues for listening, specify appropriate responses and construct a summary.

CO4: Interpret the given technical graphical representation and compose passages. Summarize and paraphrase technical text sin about 250 to 300 words.

CO5: Apply the rules of the grammar viz, word formation, nouns, adjectives, adverbs, tenses, concord, phrasal verbs and idioms and use appropriate patterns in the given sentence.

##### 19MAM12 - APPLIED ALGEBRA

CO1: Gain knowledge in sequences and series to analyse and study their area of applications

CO2: Become familiar in linear algebra concepts for data analysis in economics

CO3: Identify and understand linear algebra techniques which are applied in AI and ML

CO4: To incorporate the concepts of numerical solutions of linear systems which are widely used in Computer Applications.

CO5: Apply difference equation concepts in data modeling.

##### 19MAM13 - FUNDAMENTAL STATISTICAL METHODS

CO1: To describe and discuss the key terminologies concepts, statistical tools and techniques used in statistical analysis.

CO2: To calculate and apply measures of central tendency and measures of dispersion for grouped and ungrouped data.

CO3: To analyze Probability and Probability distributions and moments of random variables.

CO4: To understand basic concepts in sampling

CO5: To analyze bivariate data using Correlation and simple Regression.

##### 19MAM14 - DATA STRUCTURES

CO1: Understand the basics programming constructs of C language and write C programs to solve problems.

CO2: Recognize the representation of arrays, stacks, queues and linked list in memory and demonstrate its use in algorithms.

CO3: Solve computational problems using data structures such as arrays, stacks, queues and singly linked list.

CO4: Compare and use appropriate data structures in programming real world applications.

CO5: Learn and apply basic searching and sorting techniques in applications.

### **19MAM15 - THEORY OF PROGRAMMING LANGUAGES**

CO1: Identify the paradigms of programming languages.

CO2: Apply the concept of imperative programming in program development

CO3: Analyze various components of object-oriented programming and apply them for real-world applications.

CO4: Understand the concepts of Functional, logical and Assembly language programming and relate them to apply in various programming languages.

CO5: Identify the suitable programming language and apply the concepts to solve the given real world problems.

### **19MAM16 - ALGEBRA AND STATISTICS LAB**

CO1: Solve problems in linear algebra using Scilab scripts and commands

CO2: Compute measures of central tendency and dispersion using Spreadsheet's in built functions

CO3: Graphically represent statistical data using Spreadsheet tools

CO4: Analyze Bi-variate data using Spreadsheet's Data Analysis Tools

CO5: Develop skills in writing script files and analyze data using Scilab and Spreadsheet's Data Analysis Pack

### **19MAM17 - DATA STRUCTURES LAB**

CO1: Solve the given problem by devising an algorithm and implementing it into a program.

CO2: Develop reusable and efficient solutions using functions, pointers and structures.

CO3: Write programs to perform operations on strings using library functions

CO4: Implement stacks, queues and singly linked list using Arrays

CO5: Write programs to implement linear search, binary search and sorting algorithms like selection, insertion and bubble sort.

### **19MAM18 - PYTHON PROGRAMMING LAB**

CO1: To write, test, and debug simple Python programs.

CO2: To implement Python programs using conditional, control and repetition statements.

CO3: Use functions and recursive functions for structuring Python programs.

CO4: Represent compound data using lists, sets, tuples, dictionaries.

CO5: Read and write data from or to files in Python.

### **19FYEL11 - EMPLOYABILITY SKILLS**

CO1: Given strictly timed objective questions on logical reasoning and verbal ability solve within the given time.

CO2: For a given specific speaking task on topics like describing a picture, movie reviews, storytelling, and extempore generate ideas and speak confidently.

CO3: For a given social situation viz., greeting, thanking, congratulating, apologizing and giving directions, demonstrate command over conversations using appropriate functional expressions.

CO4: For a given 2 to 5 minutes speaking activity like Extempore and Debate, produce language structures accurately and fluently. For a given technical topic, prepare a power point presentation for 15 minutes.

CO5: Given short conversations and monologues for listening, specify appropriate responses and construct a summary. Construct dialogues for a given social scenario and interpret the given graphic information and write creative paragraphs.

## **SEMESTER 2**

### **19MAMLE01 - PROFESSIONAL ENGLISH**

CO1: Apply the rules of grammar namely Active and Passive voice, Direct and Indirect speech, Purpose and Function, Articles and Prepositions, Conjunction, Conditional sentences and use suitable patterns in a given sentence or passage.

CO2: Construct appropriate responses to greet, transfer, place the caller on hold, enquires, call backs, unintentional disconnects, interruptions, using suitable language and telephoning etiquettes. Given a business communication scenario construct a suitable strategy and action plan using specific negotiation tactics consistent with the objectives of the negotiator.

CO3: Given a communication context, specify the type and barriers to listening provide solutions and justify. For a given passage note the important points and summarize it.

CO4: Given a business communication scenario, compose a Business Letters, Memo, Emails, Reports, Technical Proposals, Instructions and Recommendation and checklist using appropriate language and format. For a given job requirement, prepare a job application letter with resume.

CO5: Generate valid points for and against the topic and present them with appropriate group behavior for a given HR topic and for any job requirement, plan and prepare for a 20 min HR mock interview.

### **19FY22F - BASIC FRENCH**

CO1: Understand the basics of the Language

CO2: Write simple narration and description and speak to communicate idea.

CO3: Demonstrate confidence in Social Interactions.

### **19FY22G - BASIC GERMAN**

CO1: Understand the fundamental concepts of the Language

CO2: Write simple narration and description and speak to communicate idea.

CO3: Demonstrate confidence in Social Interactions.

### **19MAM21 - APPLIED CALCULUS**

CO1: Become familiar in calculus tools to solve problems in optimization

CO2: Understand the concepts of integral calculus with a view towards applications.

CO3: Apply differential equations modeling.

CO4: Gain knowledge in Fourier series to analyze and study pattern recognition.

CO5: Get in-depth knowledge in numerical methods which are widely used in computer applications.

### **19MAM22 - PROBABILITY DISTRIBUTIONS AND APPLICATIONS**

CO1: To understand the properties and applications of advanced probability distribution,

CO2: To determine the moments and moment generating functions of important probability distributions and to impart knowledge on the functions of random variables.

CO3: To provide a good knowledge on the various methods of estimation of parameters.

CO4: To apply various tests of Statistical Hypothesis on a given statistical data.

CO5: Demonstrate the use and applications of Bayesian Analysis

### **19MAM23 - COMPUTER SYSTEM ARCHITECTURE**

CO1: Understand the basic structure and operation of digital computer

CO2: Perform arithmetic operation on the various number systems and conversions among them

CO3: Apply Boolean algebra to solve logic functions.

CO4: Understand the basics of pipelining and I/O interfaces.

CO5: Evaluate the performance of memory systems.

CO6: Understand parallel processing architectures and GPUs.

### **19MAM24 - ADVANCED DATA STRUCTURES**

CO1: Implement the linked representation and traversal operations on singly and doubly linked list.

CO2: Gain knowledge on non-linear data structures such as trees and graphs and use them in programming applications.

CO3: Solve problems using data structures such as AVL search trees, heaps and m-way search trees.

CO4: Apply appropriate sorting techniques for solving real-time problems.

CO5: Understand the working principle of hashing and collision resolution techniques

### **19MAM25 - CALCULUS AND PROBABILITY LAB**

CO1: Solve Differential Equations of first and second order using R commands

CO2: Understand properties of probability distributions using R programming and MS-Excel Tools

CO3: Calculate definite integrals numerically using Trapezoidal and Simpson's methods

CO4: To perform Statistical Hypothesis testing using R programming.

CO5: To analyze the data using Bayesian data analysis technique with the aid of R programming.

### **19MAM26 - PROGRAMMING PARADIGM LABORATORY**

CO1: Understand the usage of different programming constructs of procedural programming

CO2: Apply the principles of object-oriented programming to solve problems

CO3: Implement the concepts of logic programming and solve real world problems.

CO4: Develop solutions for problems using the concepts of functional programming paradigm.

CO5: Given a problem, develop solutions for it by applying all the four programming paradigms and compare it.

### **19MAM27 - ADVANCED DATA STRUCTURES LAB**

CO1: Implement linked representation of linked list and its operations.

CO2: Implement and compare the complexities of various sorting algorithms including bubble sort, heap sort and quick sort.

CO3: Ability to define and apply tree data structures and binary search trees for real time applications.

CO4: Perform operations on graphs and heaps for real time problems.

CO5: Implement shortest path algorithms and hashing techniques for a given application.

### **19FYEL21 - ENGLISH FOR EMPLOYABILITY**

CO1: Given strictly timed objective questions on logical sequence of words, sequential order of things, comparison, and sentence correction, solve within the given time.

CO2: For a given specific speaking task on topics like Just a Minute Describing an object, book review and extempore generate ideas and speak confidently.

CO3: For a given social situation viz., Travel and Transport, complaining, giving instructions, advising and sympathizing, requesting and warning people, communicate effectively to peer using appropriate functional language.

CO4: For a given HR topic, generate valid points for and against the topic and present them with appropriate group behavior. For any job requirement, plan and prepare a 20 min HR mock interview.

CO5: For any job requirement, plan and prepare a 20 min HR mock interview.

### **SEMESTER 3**

#### **19MAM31 - ARTIFICIAL INTELLIGENCE**

CO1: Apply various heuristic search strategies in optimal decision making

CO2: Understand uncertainty in real world situations.

CO3: Employ first order logic for building knowledge base and demonstrate reasoning on this

CO4: Express different planning strategies to deal with problems, describe and apply various knowledge representation techniques.

CO5: Familiarize knowledge-based AI systems and approaches.

#### **19MAM32 - THEORY OF COMPUTING**

CO1: Understand different types of grammars and develop grammars to produce specific solutions

CO2: Develop designs for different machine types: finite automata, pushdown automata and Turing machines.

CO3: Understand partial recursive functions and its relationship to programs

CO4: Understand approaches to building a compiler

CO5: Understand approaches to proving a program

#### **19MAM33 - DATABASE MANAGEMENT SYSTEMS**

CO1: Describe the purpose and architecture of database systems from the perspective of persistent storage of real-world data.

CO2: Analyze the problem statement, construct the Entity Relationship model and map it into relational model by applying normalization.

CO3: Generate Relational Algebra, Relational Calculus and SQL statements to perform queries of real-world applications

CO4: Evaluate the indexing techniques and choose the suitable technique by analyzing the given application

CO5: Determine the concurrency control and recovery mechanisms based on the criticality of the transaction

#### **19MAM34 - PREDICTIVE ANALYTICS**

CO1: Analyze time series data and apply it to forecast the future.

- CO2: Formulate and compute multiple linear regression model and understand its properties.
- CO3: Classify objects into different groups using discriminant function, logistic regression equation.
- CO4: Identify underlying factors in multivariate data sets using principal component analysis.
- CO5: Understand the terminology of factor analysis, factor rotation and interpret factor loadings using R programming.

### **19MAM35 - HUMAN COMPUTER INTERACTION**

- CO1: Learn the foundations of Human Computer Interaction (HCI)
- CO2: Be familiar with the design technologies for individuals and persons with disabilities
- CO3: Be familiar with models and theories of HCI
- CO4: Develop an understanding of the intricacies of web HCI
- CO5: Learn to design web interfaces and to gain knowledge in use cases of web interface.

### **19MAM36 - ARTIFICIAL INTELLIGENCE LAB**

- CO1: Design and implement heuristic search procedures
- CO2: Develop constraint satisfaction problem solution
- CO3: Design and implement solutions for classical Artificial Intelligence problems
- CO4: Design and implement knowledge-based system
- CO5: Become familiar with use of Artificial Intelligence tools

### **19MAM37 - DATABASE MANAGEMENT SYSTEMS LAB**

- CO1: Design the conceptual data model as Entity Relationship diagram and create the database using DDL statements for a given application.
- CO2: Formulate simple DML SQL queries to retrieve the required data for real world applications
- CO3: Generate DML queries with Subqueries, Joins, Group By, Order By and Aggregate functions to filter and aggregate the data of the real world applications.
- CO4: Construct reusable PL/SQL blocks with Functions, Procedures, Packages, Triggers, Exception Handling, and Cursors as required by OLTP applications.
- CO5: Develop a database project by constructing the ER model, creating Tables and generating SQL and PL/SQL blocks using RDBMS platform.

### **19MAM38 - PREDICTIVE ANALYTICS LAB**

- CO1: Use R software to analyze multivariate data using multiple linear regression, discriminant function, logistic regression equation models and cluster analysis tools
- CO2: Using R software to analyze Time Series Models
- CO3: Identify underlying factors in multivariate data by applying factor analysis and principal component analysis models using R software packages
- CO4: Use R software to retain the components and loading of the Principal Components
- CO5: Use R to verify the data and to estimate the parameters of a factor model.

### **19MAMOC02 – JAVA PROGRAMMING**

- CO1: Able to learn and implement classes and objects in Java.
- CO2: Able to apply inheritance and create interfaces for the given requirement.
- CO3: Able to handle the different kinds of exceptions arising in a Java program.
- CO4: Able to use IO streams for reading and writing data in Java.
- CO5: Able to write socket programs in Java to create network applications.

## **SEMESTER-4**

### **19MAM41 - OPERATIONS RESEARCH**

- CO1: Solve Linear Programming, Transportation and Assignment based problems.
- CO2: Discuss the elementary Inventory models, Price break models and Safety stock problems.
- CO3: Solve Job sequencing and replacement problems.
- CO4: Categorize the Queuing models and also simulate the problems using Monte - Carlo Technique.
- CO5: Analyze the network models using CPM and PERT.

### **19MAM42 - MACHINE LEARNING**

- CO1: Recognize fundamental issues and challenges of machine learning: data, model selection, model complexity, supervised and unsupervised learning.
- CO2: Apply Decision trees and Artificial Neural Networks in classification
- CO3: Distinguish the strength and weakness of Bayesian learning.
- CO4: Analyze and use Instance based learning and reinforcement learning in real time problems.
- CO5: Learn association rules and clustering methods to derive insights from data.

### **19MAM43 - DESIGN AND ANALYSIS OF ALGORITHMS**

- CO1: Able to apply divide and conquer, greedy methods in problem solving
- CO2: Able to use dynamic programming in real time problems and derive efficient solutions
- CO3: Able to understand the concepts of backtracking and branch-bound techniques.
- CO4: Able to differentiate between NP, NP hard and NP Complete problems.
- CO5: Able to analyze the efficiency of different algorithm design techniques and their proper usage in application problems.

### **19MAM44 - DATA COMMUNICATIONS AND NETWORKING**

- CO1: Enumerate the layers of the OSI model and TCP/IP and compare the models.
- CO2: Describe the relationship between data and signals, and distinguish among their types, behavior, properties, characterization, and transmission.
- CO3: Given an inter-network topology configuration, can demonstrate how a packet reaches the destination.
- CO4: Explain the services offered by each layer of TCP/IP protocol suite and the role of each protocol.
- CO5: Given an application, can explain the role of the protocols involved.

### **19MAM45 - OPERATING SYSTEMS**

- CO1: Demonstrate the structure of operating system, batch programming, system calls and virtual machines

CO2: Demonstration of Kernel Management specific to concurrent process for Inter Process Communication systems

CO3: Estimate system performance through scheduling algorithms - FIFO, round robin, priority, shortest job first

CO4: Recognize memory allocation and deallocation for both static and dynamic storage

CO5: Design and develop a new simple File System using Disk and File System Management

### **19MAM46 - MACHINE LEARNING LAB**

CO1: Able to prepare the data for machine learning using data pre-processing and dimension reduction techniques.

CO2: Able to build regression and classification models using benchmark datasets and give insights.

CO3: Able to evaluate the performance of models using different performance measures.

CO4: Able to use clustering techniques to group data and analyse the clusters.

CO5: Able to design and develop prediction systems by choosing appropriate machine learning algorithms using real-time datasets.

### **19MAM47 - DESIGN AND ANALYSIS OF ALGORITHMS LAB**

CO1: Ability to analyze the efficiency of different algorithm design techniques and their proper usage in application problems.

CO2: Implementing string matching and network flow algorithms.

CO3: Able to apply data structure concepts in any applications of the dynamic programming

CO4: Implement the design technique of backtracking in application to analyse the types of problem solved using backtracking.

CO5: Skill to compare, contrast, and understand the choice of various design techniques to solve a given problem.

### **19MAM48 - NETWORK PROGRAMMING LAB**

CO1: Understand key protocols that support communication.

CO2: Develop and implement connection-oriented and connectionless communication using Socket API for a given set of requirements.

CO3: Develop and implement concurrent and iterative servers and analyze their functionality.

CO4: Apply advanced programming techniques such as Broadcasting and Multicasting.

CO5: Develop and implement simple network applications using NS-2 API for a given set of requirements and demonstrate its working.

## **SEMESTER-5**

### **19MAM51 - ADVANCED MACHINE LEARNING**

CO1: Use ensemble techniques and dimensionality reduction methods for building machine learning models.

CO2: Understand the optimization techniques and regularization adopted in machine learning algorithms.

CO3: Learn the properties of kernels, kernel functions and apply them in pattern analysis.

CO4: Recognize the application of markov chain approaches for random sampling and model probabilities and use them in applications.

CO5: Apply the concept of graphical models in machine learning problems

### **19MAM52 - ARTIFICIAL NEURAL NETWORKS**

CO1: Learn the fundamentals concepts of the Neural Network and its various applications.

CO2: Identify and describe Artificial Neural Network techniques in building intelligent machines.

CO3: Understand the different types of unsupervised learning techniques of Artificial Neural Networks.

CO4: Apply Radial Belief Network for Classification problems

CO5: Implement associative memories using neural networks

### **19MAM53 - KNOWLEDGE BASED SYSTEMS**

CO1: Understand the concepts central to the creation of knowledge bases and expert systems.

CO2: Identify the components of a knowledge based systems(KBS)

CO3: Explore the issues involved in the design and development of Artificial Intelligence Based Decision Support Systems and discuss the role these systems play in the business environment.

CO4: Select an appropriate knowledge representation and reasoning method, and anticipate potential difficulties in developing and introducing the expert systems.

CO5: Examine properties of knowledge search techniques and understand the application domains of KBS.

### **19MAM54 - AI SYSTEMS ENGINEERING**

CO1: Understand the concept of an Intelligent System (IS) and goals of AI-Enabled Systems

CO2: Create intelligence using different approaches including machine learning

CO3: Implement production-quality systems that are robust to mistakes of AI components

CO4: Compare the intelligence and evaluate the accuracy of the AI-based systems using appropriate methods.

CO5: Build an AI based system from end to end and leverage machine learning in practice.

### **19MAM55 - DISTRIBUTED AND CLOUD COMPUTING**

CO1: Explain the core concepts of the cloud computing paradigm

CO2: Compare the service models offered by different service providers and choose appropriate platforms for implementing cloud computing solutions considering management, security and trust requirements.

CO3: Analyze various cloud programming models and apply them to solve problems on the cloud.

CO4: Elucidate the concept, features, use cases, and benefits of containers, and the difference between containers and virtual machines.

CO5: Explain the basic concepts of microservices and container orchestration.

### **19MAM56 - ADVANCED MACHINE LEARNING LAB**

CO1: Implement bagging, boosting and dimensionality reduction techniques in classifier models

CO2: Apply Random Forest classification method in classification problems of machine learning.

CO3: Use support vector classifier, regression, HMM and Bayesian Belief networks on real-time datasets and draw insights.

CO4: Implement perceptron for logic gates.

CO5: Design and implement Artificial Neural Network and Radial Belief Network to classify images.

### **19MAM57 - FULL STACK WEB DEVELOPMENT LAB**

CO1: Develop web pages that function using external data -HTML and CSS.

CO2: Use JavaScript to implement client-side validations and perform AJAX calls

CO3: Apply AngularJS and /ReactJS to develop frontend dynamic web UI

CO4: Implement CRUD operations on database (MongoDB) in NODE.js

CO5: Build end-to-end web applications handling all the areas of the tech-stack and any of the web frameworks.

### **19MAM58 - CLOUD COMPUTING LAB**

CO1: Demonstrate knowledge on creating, cloning, migrating virtual machines using VirtualBox, a virtualization tool.

CO2: For a given system configuration, can use EC2 to acquire instances.

CO3: Develop applications, launch it on Google App Engine, and access it with proper authentication mechanisms.

CO4: Construct a private cloud using the opensource cloud technologies such as OpenStack/ CloudStack/ OpenNebula for a given requirement.

CO5: Given an application, can create Micro services, can containerize, and deploy.

### **19MAM59 - PERSONALITY DEVELOPMENT**

CO1: Ascertain the various concepts of Self like the Physical Self – Energy Self – Intellectual Self – Mental Self – Blissful Self with respect to the Western (Occidental) and Eastern (Oriental) theories of Self and Personality Development.

CO2: Outline the significant effects of Self Confidence to build team confidence, given the foundation principles of Self-Motivation and Confidence.

CO3: Assess the various personalities and Attitudes and choose the best attitude for making bold decisions in personal and professional contexts.

CO4: Project the appropriate grooming and the right etiquette in the corporate context to excel in professional life.

CO5: Set Career goals and formulate strategies by Prioritizing, organizing and scheduling the required tasks. Project the appropriate grooming and the right etiquette in the corporate context to excel in professional life.

### **19MAM61 - INTELLIGENT AGENTS**

CO1: Understand agents. agent types, structure and their interactions

CO2: Appreciate the utility of different types of AI agents.

CO3: Learn and use multi agent systems and their interactions to reach agreements.

CO4: Demonstrate communication language used by the agents for their coordination and coherence.  
CO5: Review the cooperative distributed problem-solving techniques used by agents with task and result sharing.

### **19MAM62 - DEEP LEARNING**

CO1: Understand the concepts of feedforward and deep networks and regularization principles.  
CO2: Implement and visualize Convolutional Neural Networks algorithms for classification problems.  
CO3: Identify Recurrent Neural Network algorithms which are more appropriate for various types of learning tasks in various domains.  
CO4: Review the unsupervised deep learning models- deep generative models and autoencoders for predictive learning.  
CO5: Apply the optimization techniques and fine tune the deep neural networks while designing deep learning algorithms for varied applications.  
CO6: Learn the basics of transfer learning and its application in deep learning

### **19MAM63 - INFORMATION RETRIEVAL AND WEB SEARCH**

CO1: Understand the basic concepts and techniques in information retrieval  
CO2: Apply the information retrieval models.  
CO3: Evaluate an information retrieval system based on the relevance of the documents it retrieves.  
CO4: Analyze the documents and query performances of system  
CO5: Explore the techniques in text and multimedia retrieval process

### **19MAM64 - BIG DATA ANALYTICS**

CO1: Learn the concepts of big data characteristics and its applications  
CO2: Apply map-reduce programming to parallelize data centric problems using Hadoop and HDFS  
CO3: Exposure to data analytics using various Hadoop ecosystem tools.  
CO4: Understand stream processing and perform stream analytics on real-time problems.  
CO5: Implement real-time streaming analytics using Spark Streaming API.

### **19MAME14 - AGILE SOFTWARE DEVELOPMENT**

CO1: Understand the key principles of agile management.  
CO2: Learn agile Project Management process and agile project planning.  
CO3: Apply agile development management and product management in system development.  
CO4: Identify the need for scrum and use scrum tools.  
CO5: Compare scrum with conventional project management and waterfall methods.

### **19MAME01 - ETHICS IN AI**

CO1: Understand the concept of building ethics in machines

CO2: Develop and designs test cases for hypothetical cases in Self driving cars

CO3: Able to build the methodologies for ethical AI

CO4: Identify Ethical priorities in AI systems

CO5: Design AI with rights, consciousness, and freedom

### **19MAM65 - DEEP LEARNING LAB**

CO1: Design single and multi-layer feed-forward deep networks and tune various hyper-parameters.

CO2: Build classification models using convolutional neural networks, recurrent neural networks for real-time applications.

CO3: Implement hyperparameter tuning and optimization techniques to improve the performance of the Deep neural networks.

CO4: Use of LSTM network in real-time prediction problems.

CO5: Apply pretrained models in practice with large image datasets and perform classification efficiently.

### **19MAM66 - MOBILE APPLICATION DEVELOPMENT LAB**

CO1: Understand the components and structure of mobile application development frameworks for Android and windows OS-based mobiles.

CO2: Work with various mobile application development frameworks and develop mobile apps.

CO3: Apply the basic UI and important design concepts and issues of development in mobile applications.

CO4: Develop mobile apps for Android OS using GPS, Storage and RSS feed.

CO5: Design mobile applications based on the capabilities and limitations of mobile devices.

### **19MAM67 - BIG DATA ANALYTICS LAB**

CO1: Write MapReduce programs to work on Hadoop clusters.

CO2: Work with NoSQL -MongoDB for learning basic CRUD operations.

CO3: Learn and apply basic Hadoop commands and read/write data to HDFS

CO4: Implement supervised and unsupervised machine learning algorithms using SparkML library.

CO5: Perform stream analytics using real time Spark framework.

### **19MAM68 - COMMUNICATION SKILLS**

CO1: Conceive appropriate verbal responses from the learners to a given social situation, using the guidelines to effective speaking skills and body language.

CO2: Generate troubleshooting solutions to develop team building and interpersonal skills with case studies that focus on body language and empathy.

CO3: Develop appropriate responses for business phone calls and formulate effective resolutions to professional conflicts that arise out of cross-cultural communication gaps in a given managerial context.

CO4: Compose appropriate written responses to professional problems faced by a team at the workplace arising out of ineffective communication skills.

CO5: Generate valid points for and against a HR topic and present them with appropriate group behavior. For any job requirement, plan and prepare for a 20-minute mock interview.

### **19MAM69- HACKATHON**

CO1: To familiarize students about the various problems in Hackathons and encourage them to participate so as to improve their programming skills

CO2: To gain experience in solving real-time problems and challenges of industry in the domain of AI/ML.

CO3: To explore and research the current trends in the area of AI/ML

### **SEMESTER-VIII**

#### **19MAM81 - GRAPH REPRESENTATION LEARNING**

CO1: Understand the fundamental concepts of graph theory.

CO2: Familiarize with the different graph reconstruction methods.

CO3: Model Graph Neural Networks to solve real-time problems

CO4: Apply Graph Generative Models for finding solutions for complex data problems

CO5: Learn about knowledge graph and its representation

#### **19MAM82- REINFORCEMENT LEARNING**

CO1: Familiarize with the fundamentals of Reinforcement Learning.

CO2: Understand and apply basic RL algorithms for simple sequential decision-making problems in uncertain conditions.

CO3: Examine the various model-based and model-free methods for model planning and learning.

CO4: Review the application of approximation-based algorithms for Reinforcement Learning

CO5: Learn the applications and latest trends in Reinforcement Learning

CO6: Implement reinforcement learning algorithms to solve a cognitive task

#### **19MAM83 - META-HEURISTIC OPTIMIZATION TECHNIQUES**

CO1: Understand the basic concepts of heuristic optimization.

CO2: Familiarize with genetic and evolutionary algorithm and its applications in real world problem solving.

CO3: Apply Ant colony optimization algorithmic models for various optimization problems.

CO4: Implement particle swam optimization algorithm and Firefly algorithms for problem solving.

CO5: Solve computational problems using Honeybee optimization techniques.

#### **19MAM84 – META-HEURISTIC OPTIMIZATION LAB**

CO1: Implement optimization techniques on specific applications

CO2: Understand and perform Binary and Continuous Genetic Algorithm in real time application

CO3: Apply evolutionary computation methods to solve complex problems

CO4: Learn and use various Extreme Learning Machine techniques for real time application

CO5: Summarize current research in Genetic Algorithms and Evolutionary Computing

## **SEMESTER-IX**

### **19MAM91 - COMPUTER VISION**

CO1: Understand and use the vision technology in conjunction with real world applications.

CO2: Detecting features, discuss feature correspondences across different images and review image segmentation techniques like Active contours, Split and merge, mean shift and mode finding.

CO3: Investigate techniques like shading and focus, merging multiple range or depth images into 3D models, and reconstructing them.

CO4: Perform pose estimation, camera's intrinsic calibration, estimate 3D point structure from 2D matches, 3D geometry, camera motion and the motion between two or more images.

CO5: Reconstruct the 3D shape of a scene from images taken from different views.

### **19MAM92 - CYBER THREAT INTELLIGENCE**

CO1: Familiarize with the concepts of cyber threat intelligence and its requirements.

CO2: Identify methods to collect cyber threat intelligence Requirements

CO3: Analyze and Disseminate Cyber Threat Intelligence

CO4: Understand the role of cyber threat intelligence partner

CO5: Apply machine learning techniques to detect cyber security threats in web, network, emails etc.

### **19MAM93 – COMPUTER VISION LAB**

CO1: Explore the process of image construction and blending

CO2: Apply Image formation techniques and feature based process

CO3: Extract features from Images and do analysis of Images

CO4: Perform object detection and face recognition using CNNs and RCNNs.

CO5: Implement image classification using benchmark image datasets like CIFAR-10 and other types of images.

### **19MAM94 - INTELLIGENT CYBER SECURITY LAB**

CO1: Apply classification techniques for detection

CO2: Perform Preprocessing technique in face detection

CO3: Perform clustering technique for cyber security

CO4: Implement various techniques and security algorithms on specific problems.

CO5: Develop intelligent solutions/tools to detect and protect against cyber threat through data analytics for an enterprise.

**B.Tech IT**

**Semester -I**

### **19FYM14 MATRICES AND CALCULUS**

*(Common to CSE & IT Programmes)*

#### **COURSE OUTCOME**

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

- CO1 : Assimilate the ideas of eigenvalues and eigenvectors and an ability to calculate and apply them*
- CO2 : Improve the facility in differentiation and its applications.*
- CO3 : Fluency in multiple integration using standard methods, including the ability to find an appropriate method for the given integral.*
- CO4 : Accelerate the vector calculus ideas to prove some important theoretical results .*
- CO5 : Demonstrate accurate and efficient use of ordinary differential equations.*

### **19FYE11 TECHNICAL ENGLISH**

#### **COURSE OUTCOME**

*Upon completion of this course the students will be able to demonstrate ability to*

- CO1 : Given a social context, compose appropriate dialogues using functional words, Construct Descriptive Paragraphs and reviews using sequencing words and unity of thought.*
- CO2 : Given a communication context, categorize the barriers to communication and formulate solutions. For a given communication situation, like introducing oneself, asking questions, disagreeing, expressing preferences, asking for and giving directions, generate functional expressions and construct dialogues.*
- CO3 : Given short conversations and monologues for listening, specify appropriate responses and construct a summary.*
- CO4 : Interpret the given technical graphical representation and compose passages. Summarize and paraphrase technical texts in about 250 to 300 words.*
- CO5 : Apply the rules of the grammar viz, word formation, verbs, tenses, question tags, prepositions, articles, conjunctions, concord, Idiomatic expressions, one word substitutes, Homophones and homonyms, linking words, adjectives and Degrees of Comparison, use appropriate patterns in the given sentence.*

## **19FYP13 ENGINEERING PHYSICS**

*(Common to EEE, CSE and IT Programmes)*

### **COURSE OUTCOME**

1. *The students will gain knowledge and understanding of lasers and optical fibers.*
2. *The students will have a conceptual understanding about quantum mechanics and acquire basic knowledge about nano materials.*
3. *The students will be able to demonstrate competency and understanding of the electrical properties of conductors and dielectrics.*

## **19FYC11 ENGINEERING CHEMISTRY**

*(Common to Civil, Mechanical, EEE, ECE, CSE and IT Programmes)*

### **COURSE OUTCOME**

- 1) *The students will be able to calculate the calorific value of different types of fuels and apply the same for suitable application.*
- 2) *The student will be conversant with the principles and implication of corrosion and its application*
- 3) *The students will be able to familiarize with various types of material analysis.*
- 4) *The students will be able to synthesize the nano materials of different size and shapes using different synthesis technique and apply the same for the energy conversion and storage devices.*

## **19CSL12 PYTHON PROGRAMMING**

*(Common to CSE & IT programmes)*

### **COURSE OUTCOME**

- CO1 : *Understand the fundamental concepts of computers and basic blocks of programming.*
- CO2 : *Apply control statements, decision making statements to solve the given problems.*
- CO3 : *Usage of complex data types in python to develop on application.*
- CO4 : *Practice problem solving using functions and string operations.*
- CO5 : *Solve the real - world problems using file handling operations, modules, packages and error handling methods.*

## **19MEL11 ENGINEERING GRAPHICS**

### **COURSE OUTCOME**

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

*CO1 : Understand the importance of BIS and ISO Standards in Engineering Drafting.*

*CO2 : Imagine and visualize the geometric details of engineering objects.*

*CO3 : Communicate ideas through technical drawings.*

*CO4 : Use computer aided drafting in their respective engineering field.*

*CO5 : Interpret Orthographic and Isometric views of objects.*

## **19PL21 PHYSICS LABORATORY II**

*(Common to Civil, Mechanical, EEE, ECE, CSE and IT Programmes)*

### **COURSE OUTCOME**

*The student will be able to gain a fundamental understanding of the apparatus used in the experiments and recognize how observation, experiment and theory work together.*

## **19CL21 CHEMISTRY LABORATORY II**

*(Common to Civil, Mechanical, EEE, ECE, CSE and IT Programmes)*

### **COURSE OUTCOME**

- i. By performing EDTA titrations, the students could understand how hardness producing salts create boiler troubles and how to quantify hardness producing ions present in raw water.*
- ii. By the determination of weight loss method, the student will be able calculate rate of corrosion*
- iii. Students are able to handle analytical tools such as spectrophotometer, flame photometer, conductometer and potentiometer.*

## 19FYEL21 ENGLISH FOR EMPLOYABILITY

### COURSE OUTCOME

- CO1 : Given strictly timed objective questions on logical sequence of words, sequential order of things, comparison, and sentence correction, solve within the given time.
- CO2 : For a given specific speaking task on topics like JAM, Describing an object, Book Review and Extempore, Generate ideas and speak confidently.
- CO3 : For a given social situation viz., Travel and Transport, Complaining, Giving Instructions, Advising and Sympathizing, Requesting and Warning people, Communicate effectively to peer using appropriate functional language.
- CO4 : For a given HR topic, generate valid points for and against the topic and present them with appropriate group behavior. For any job requirement, plan and prepare a 20 min HR mock interview.

## 19PL11 PHYSICS LABORATORY I

(Common to Civil, Mechanical, EEE, ECE,CSE and IT Programmes)

### COURSE OUTCOME

The student will be able to gain a fundamental understanding of the apparatus used in the experiments and recognize how observation, experiment and theory work together.

## 19CL11 CHEMISTRY LABORATORY I

(Common to Civil, Mechanical, EEE, ECE,CSE and IT Programmes)

### COURSE OUTCOME

- i. By the estimation of dissolved oxygen present in water, the student will be able to appreciate how oxygen in water causes corrosion of boiler materials. Students are able to handle analytical tools such as of conductometer and pH meter.
- ii. Students will gain an understanding of different types of volumetric titration.

## 19MEL12 ENGINEERING PRACTICES LABORATORY

### **COURSE OUTCOME**

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

- CO1 : Understand various engineering practices like carpentry, fitting, sheet metal, plumbing and electrical wiring and relevant tools.*
- CO2 : Identify and rectify minor electrical problems at home and office.*
- CO3 : Implement the skills acquired during their project work.*
- CO4 : Develop their hand-eye coordination capabilities.*

## 19FYEL11 EMPLOYABILITY SKILLS

### **COURSE OUTCOME :**

- Given strictly timed objective questions on logical reasoning and verbal ability solve within the given time.
- For a given specific speaking task on topics like describing a picture, movie reviews, and story telling, generate ideas and speak confidently.
- For a given social situation viz., greeting, thanking, congratulating, apologizing and giving directions, demonstrate command over conversations using appropriate functional expressions.
- For a given 2 to 5 minutes speaking activity like Extempore and Debate, produce language structures accurately and fluently. For a given technical topic, prepare a power point presentation for 15 minutes.
- Given short conversations and monologues for listening, specify appropriate responses and construct a summary. Construct dialogues for a given social scenario and interpret the given graphic information and write creative paragraphs.

## Semester –II

### 19FYM24 FOURIER SERIES AND PARTIAL DIFFERENTIAL EQUATIONS

*(Common to CSE and IT programmes)*

#### COURSE OBJECTIVE

*Throughout the course, students will be expected to demonstrate their understanding of numerical solutions of differential equations and Fourier series by being able to do each of the following*

- ♦ *To inculcate an idea of numerical solutions of ordinary differential equations.*
- ♦ *To Apply Fourier series to solve variety of problems.*
- ♦ *To Establish a sound grasp of knowledge on basics, significance and growth of partial differential equations.*
- ♦ *To provide the required fundamental concepts in partial differential equations and Fourier series through numerical and analytical solutions and use these techniques in boundary value problems.*

### 19FYE21 PROFESSIONAL ENGLISH

#### COURSE OUTCOME

- CO1 : *Apply the rules of grammar namely Active and Passive voice, Direct and Indirect speech, Cause and effect, Purpose and Function, Prepositions, Conditional sentence, Modal verbs and use suitable patterns in a given sentence or passage.*
- CO2 : *Construct appropriate responses to greet, transfer, place the caller on hold enquires, callbacks, unintentional disconnects, interruptions, using suitable language and telephoning etiquettes. Given a business communication scenario, construct a suitable strategy and action plan using specific negotiation tactics consistent with the objectives of the negotiator.*
- CO3 : *Given a communication context, specify the type and barrier to listening, provide solutions and justify. For a given passage, categorize information and complete the passage using appropriate vocabulary and grammatical form.*
- CO4 : *Given a business communication scenario, compose Business Letters, Memo, Emails, Reports, Minutes of the Meeting, Technical Proposals, Instructions and Recommendation and Checklists using appropriate language and format. For a given job requirement, prepare a job application letter with resume.*
- CO5 : *For a given communication content viz., Giving Advice and Suggestions, Apologizing, Asking for Giving Permission, construct dialogues with appropriate functional expressions.*

## **19FYG21 - BASIC GERMAN**

### **OUTCOME**

*At the end of the semester the students will :*

- Understand the fundamental concepts of the Languages.
- Write simple narration, description and speak to communicate idea.
- Demonstrate confidence in Social Interactions

## **19FYF21 - BASIC FRENCH**

### **OUTCOME**

*At the end of the semester the students will :*

- Understand the basics of the Language
- Write simple narration and description and speak to communicate idea.
- Demonstrate confidence in Social Interactions.

## **19FYP24 INTRODUCTION TO ELECTRONIC DEVICES**

*(common to CSE and IT programmes)*

### **COURSE OUTCOME**

*The student will be able to*

**CO1** : *To understand operation and switching characteristics of electronic devices.*

**CO2** : *To gain knowledge about the working details, major applications of BJT, FET, power devices and display devices.*

**CO3** : *To realize simple practical circuits.*

**CO4** : *To acquire knowledge on basic Nano electronics.*

## **19FYC21 ENVIRONMENTAL SCIENCE AND ENGINEERING**

*(Common to Civil, Mechanical, EEE, ECE, CSE and IT Programmes)*

### **COURSE OBJECTIVE**

- ♦ *To study the nature and facts about environment.*
- ♦ *To find and implement scientific, technological, economic and political solutions to environmental problems.*
- ♦ *To study the interrelationship between living organism and environment.*
- ♦ *To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.*
- ♦ *To study the dynamic processes and understand the features of the earth's interior and surface.*
- ♦ *To study the integrated themes and biodiversity, natural resources, pollution control and waste management.*

## **19CS21 - C PROGRAMMING**

*(Common to CSE and IT programmes)*

### **COURSE OUTCOME**

- CO1 : *Fundamental Knowledge in problem solving, designing algorithms and representation through flowcharts.*
- CO2 : *Develop simple programs using decision making statements and looping constructs.*
- CO3 : *Handling series of data items through arrays and pointers.*
- CO4 : *Understand and practice modularization of the given problem using functions.*
- CO5 : *Ability to solve real world problems involving collection of data items through structures and files.*

## **19CSL11 - C PROGRAMMING LABORATORY**

*(Common to Civil , Mechanical, CSE and IT programmes)*

### **COURSE OUTCOME**

- CO1 : *Ability to write, compile and debug C programs.*
- CO2 : *Develop simple programs using decision making statements and looping constructs.*
- CO3 : *Practice operations on arrays, strings and pointer.*
- CO4 : *Practice modularization of the given problem using functions.*
- CO5 : *Write programs using structures and files.*

## **19MEL11 ENGINEERING GRAPHICS**

### **COURSE OUTCOME**

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

*CO1 : Understand the importance of BIS and ISO Standards in Engineering Drafting.*

*CO2 : Imagine and visualize the geometric details of engineering objects.*

*CO3 : Communicate ideas through technical drawings.*

*CO4 : Use computer aided drafting in their respective engineering field.*

*CO5 : Interpret Orthographic and Isometric views of objects.*

## **19PL21 PHYSICS LABORATORY II**

*(Common to Civil, Mechanical, EEE, ECE, CSE and IT Programmes)*

### **COURSE OUTCOME**

*The student will be able to gain a fundamental understanding of the apparatus used in the experiments and recognize how observation, experiment and theory work together.*

## **19CL21 CHEMISTRY LABORATORY II**

*(Common to Civil, Mechanical, EEE, ECE, CSE and IT Programmes)*

### **COURSE OUTCOME**

- i. By performing EDTA titrations, the students could understand how hardness producing salts create boiler troubles and how to quantify hardness producing ions present in raw water.*
- ii. By the determination of weight loss method, the student will be able calculate rate of corrosion*
- iii. Students are able to handle analytical tools such as spectrophotometer, flame photometer, conductometer and potentiometer.*

## 19FYEL21 ENGLISH FOR EMPLOYABILITY

### COURSE OUTCOME

- CO1 : *Given strictly timed objective questions on logical sequence of words, sequential order of things, comparison, and sentence correction, solve within the given time.*
- CO2 : *For a given specific speaking task on topics like JAM, Describing an object, Book Review and Extempore, Generate ideas and speak confidently.*
- CO3 : *For a given social situation viz., Travel and Transport, Complaining, Giving Instructions, Advising and Sympathizing, Requesting and Warning people, Communicate effectively to peer using appropriate functional language.*
- CO4 : *For a given HR topic, generate valid points for and against the topic and present them with appropriate group behavior. For any job requirement, plan and prepare a 20 min HR mock interview.*

## 15CE01 ENGINEERING MECHANICS

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

### ASSESSMENT: THEORY

#### COURSE OUTCOMES:

*At the end of this course the students will be able to*

*CO1: Determine forces and moments for equilibrium of Particles and Rigid Bodies using free body diagram*

*CO2: Analyse the effect of friction on general plane motion and analysis of truss by method of joints and sections*

*CO3: Determine Centroid, Centre of Gravity and Moment of Inertia for plane sections*

*CO4: Explain Kinetics & Kinematics of particles using equations of motion and work energy method*

*CO5: Application of equations of Statics and Dynamics to determine the unknown quantities*

## 15CE02 BUILDING MATERIALS

### ASSESSMENT: THEORY

#### COURSE OUTCOMES:

*After successful completion of the course, student will be able to*

*CO1: List and identify the stones in building construction.*

*CO2: Explain the manufacturing and test for bricks and building blocks.*

*CO3: Discuss the types and tests for cement, mortar and concrete in building construction.*

*CO4: Describe the preservation, defects for timber and discuss market forms for steel, varnishing, distemper and paints in construction industry.*

*CO5: Describe the special materials used for roofing, refractories, false ceiling and wall panels in building construction.*

## 15CE31 MECHANICS OF SOLIDS

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

### ASSESSMENT: THEORY

#### COURSE OUTCOMES:

*After successful completion of the course, student will be able to*

*CO1: Compute simple stress and strain, thermal stresses*

*CO2: Compute principal stresses and strain for two dimensional stress system, strain energy due to suddenly applied load and impact load*

*CO3: Practice shear force and bending moment computations and construct shear force and bending moment diagrams for determinate beams*

*CO4: Compute stresses related to bending, shear and torsion*

*CO5: Compute stresses in thin and thick cylinders*

## **15CE32 MECHANICS OF FLUIDS**

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

### **ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

*After successful completion of the course, student will be able to*

*CO1: Outline the basic properties of fluids in rest and motion*

*CO2: Determine the pressure at a point in a fluid at rest or in motion using manometers or mechanical gauges*

*CO3: Examine the effect of fluid pressure at rest or in motion on submerged and floating bodies and in containers*

*CO4: Computing the flow parameters in fluid flow using Continuity and Bernoulli's equation*

*CO5: Applying the concept of dimensional analysis to solve the fluid problems through model studies*

*CO6: Computing the flow parameters in pipes for laminar and turbulent flow*

## **15CE33 SURVEYING**

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

### **ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

*After successful completion of the course, student will be able to*

*CO1: Assess the field measurements by chain, compass and theodolites, Electronic theodolite, Electronic total station, EDM, GPS*

*CO2: Calculate elevations and contour of fields using dumpy and auto levels and distance with tachometer*

*CO3: Determine latitudes and departures through traversing by theodolites and determine area by triangulation*

*CO4: Calculate the elements of setting out of curves for roads and railways*

*CO5: Ascertain the area by simpson's rule and trapezoidal rule and volume by prismoidal and trapezoidal rule*

### **15CE34 CONSTRUCTION TECHNOLOGY**

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

#### **ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

*After successful completion of the course, student will be able to*

*CO1: Given the design drawings for a building, define the specifications for the materials to be used for construction.*

*CO2: Formulate the methods of construction of foundation and super structure for a building following the design drawing.*

*CO3: Formulate the methodology for construction of staircase in a building given the geometrical and structural design.*

*CO4: Develop a procedure for the fabrication and erection of the selected type of doors and windows.*

*CO5: Develop the procedure for the erection of formworks and scaffolding for construction using materials like steel and timber.*

*CO6: Describe the requirements for fire safety, thermal and sound insulation in a building.*

### **15CE35 ENGINEERING GEOLOGY**

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

#### **ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

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

*CO1: Describe about weathering, type of soils, geological work of various agents, ground water, earthquake, interior and age of earth.*

*CO2: Explain about geological subsurface features and elements of crystallography.*

*CO3: Identify minerals based on their physical properties.*

*CO4: Identify rocks based on mineralogy, texture, structure and mode of occurrence*

*CO5: Employ the geological knowledge for various projects like dams & reservoirs, tunnels, coastal protection, landslide mitigation*

*CO6: Interpret geological features and properties of rocks using fundamental principles of geophysical methods*

### **15CE36 SURVEY PRACTICAL**

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

#### **ASSESSMENT: PRACTICAL**

#### **COURSE OUTCOMES:**

*At the end of this course the students will be able to*

*CO1: Prepare area map by measuring field using chain, compass, electronic total station and determine the distance between inaccessible points*

*CO2: Assess longitudinal and cross sections, contours and to determine the elevations of given points using dumpy, auto level and electronic total station*

*CO3: Find horizontal and vertical angles and determine height of given objects using transit and electronic theodolite, Tacheometer and electronic total station*

*CO4: Practice setting out of simple curve and buildings using chain, tape, theodolite and electronic total station*

*CO5: Determine accurate distance and co-ordinates using Electronic distance meter and global positioning system.*

### **15CE37 COMPUTER AIDED BUILDING DRAWING**

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

#### **ASSESSMENT: PRACTICAL**

#### **COURSE OUTCOMES:**

*At the end of this course the students will be able to*

*CO1: Prepare the site plan, landscape design and arrange the components of building to satisfy the functional and orientation aspect*

*CO2: Sketch the detailed drawings of plan, elevation and section by manual and computer aided drawing and list the schedule of joineries*

*CO3: Prepare working drawing for the execution of civil engineering work.*

*CO4: Prepare the plumbing and electrical layout of a building*

### **15CE41 NUMERICAL METHODS**

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

## **ASSESSMENT: THEORY**

### **COURSE OUTCOMES:**

*At the end of this course the students will be able to*

*CO1: Solve linear simultaneous equations by direct and iterative methods.*

*CO2: Apply finite difference methods to solve a civil engineering problem which includes analysing the structures for shear force and bending moment, finding the deflection and vibration in beams and finding bending of laterally loaded thin plates.*

*CO3: Apply numerical integration techniques to find the deflection of non prismatic beams.*

*CO4: Apply eigen values and eigen vectors to find the principal planes, principal axes, principal stresses and principal moment of inertia.*

*CO5: Solve ordinary and partial differential equations to apply in fluid flow problems.*

## **15CE42 STRENGTH OF MATERIALS**

**L T P C**

**2 2 0 3**

## **ASSESSMENT: THEORY**

### **COURSE OUTCOMES:**

*After successful completion of the course, student will be able to*

*CO1: Determine slope and deflection of statically determinate beams*

*CO2: Draw Shear force and bending moment diagram for statically indeterminate beams and analysis of cables*

*CO3: Compute the stresses due to combined bending and axial load for short column and critical load calculation in long columns*

*CO4: Demonstrate various theories of failures for design*

*CO5: Calculate stresses due to unsymmetrical bending*

*CO6: Derive the shear centre for thin walled open sections*

## **15CE43 APPLIED HYDRAULICS AND HYDRAULIC MACHINERY**

**L T P C**

**2 2 0 3**

## **ASSESSMENT: THEORY**

### **COURSE OUTCOMES:**

*At the end of this course the students will be able to*

*CO1: Illustrate to find the hydraulically best section for open channel uniform flow and find the flow parameters*

*CO2: Describing the rate of flow of water in an open channel through notches, weirs and flumes*

*CO3: Computing the flow characteristics of non-uniform flow in open channels based on geometrical and flow parameters*

*CO4: Finding relative and absolute velocity on flat and curved vanes in rest and motion*

*CO5: Demonstrate the Pelton, Francis and Kaplan turbines and their suitability based on its performance*

*CO6: Illustrating the Centrifugal and Reciprocating pumps and their performance based on speed and head*

### **15CE44 WATER SUPPLY ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### **ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

*At the end of this course the student will be able to*

*CO1: Outline the importance of various essential demands in public water supply schemes.*

*CO2: Summarize the implications of essential primary water quality parameters and also discuss the long-term surveillance of prevailing sources of water.*

*CO3: Demonstrate the necessity and economic feasibility in transport of potable water.*

*CO4: Employ the design guidelines in conventional treatment of water.*

*CO5: Interpret and comprehend the adoption of both auxiliary treatments and economic distribution of water.*

### **15CE45 CONCRETE TECHNOLOGY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### **ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

*After successful completion of the course, student will be able to*

*CO1: State the different types of materials, all properties and tests as per codes specifications for the primary ingredients used in manufacture of concrete.*

*CO2: Illustrate the different method of designing concrete mixes for the different types of primary ingredients and admixtures as per IS code and ACI specifications. Show the improvement of concrete properties by varying the quantities of primary ingredients.*

*CO3: Explain and discuss the different methods of manufacturing concrete. Describe the different equipment used for the same*

*CO4: Discuss the properties of fresh and harden concrete as per code requirements*

*CO5: Identify the types of concretes used for special requirements.*

### **15CE46 HIGHWAY ENGINEERING**

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

#### **ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

*After successful completion of the course, student will be able to*

*CO1: Explain the types of Indian roads, organizations and pavements*

*CO2: Design the components of horizontal and vertical alignments in Highway Engineering*

*CO3: Outline the types of road construction materials and construction procedures*

*CO4: Describe the traffic engineering studies and operations*

### **15CE47 HYDRAULIC ENGINEERING LABORATORY**

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

#### **ASSESSMENT: PRACTICAL**

#### **COURSE OUTCOMES:**

*After successful completion of the course, student will be able to*

*CO1: Examining the flow meters through Venturimeter and Orificemeter*

*CO2: Calculating the major and minor losses of flow of water through pipes*

*CO3: Compute the rate of flow of water from a tank and in an open channel*

*CO4: Examine the Bernoulli's Theorem for varying cross section of pipe flow*

*CO5: Determine the metacentric height of the model of the ship in hydrostatic condition*

*CO6: Finding the performance of centrifugal, reciprocating pumps, Pelton and Francis turbines through characteristic curves*

### **15CE48 STRENGTH OF MATERIALS LABORATORY**

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

#### **ASSESSMENT: PRACTICAL**

**COURSE OUTCOMES:**

*At the end of this course the student will be able to*

*CO1: Assess the strength properties of mild steel rod and brick*

*CO2: Assess the hardness number of various materials*

*CO3: Assess the impact load on given metal.*

*CO4: Calculate the deflection of wood and springs.*

*CO5: Assess the flexural strength in beams*

**15CE51 STRUCTURAL ANALYSIS I**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>2</b>	<b>0</b>	<b>3</b>

**ASSESSMENT: THEORY**

**COURSE OUTCOMES:**

*At the end of this course, the student will be able to:*

*CO1: Identify the types of structures and explain the principle of superposition.*

*CO2: Calculate the forces of pin jointed structures by Method of tension coefficient.*

*CO3: Apply energy concepts and theorems to find the deflection of statically determinate and indeterminate structures.*

*CO4: Construct ILD for moving loads and analyze determinate and indeterminate beams.*

*CO5: Analyze two hinged and three hinged parabolic and circular arches to determine bending moment, axial thrust and radial shear force.*

*CO6: Analyze statically indeterminate beams and trusses by consistent deformation method.*

**15CE52 DESIGN OF REINFORCED CONCRETE STRUCTURAL ELEMENTS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>2</b>	<b>0</b>	<b>3</b>

**ASSESSMENT: THEORY**

**COURSE OUTCOMES:**

*At the end of this course the students will be able to*

*CO1: Explain the concepts of Working Stress and Limit State Method of Design*

*CO2: Design and detailing of beams for combined bending, shear and torsion*

*CO3: Design and detailing of one way, two way and staircase slab*

*CO4: Design and detailing of short and long columns*

*CO5: Design and detailing of isolated and combined footings for columns and wall footing*

### **15CE53 MECHANICS OF SOILS**

#### **ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

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

*CO1: Explain basic properties of soil and classify according to IS classification system.*

*CO2: Determine the permeability of soils by understanding and applying Darcy's law.*

*CO3: Compute stresses and stress increments within soil and stress due to external loads.*

*CO4: Compute settlement by understanding theory of consolidation.*

*CO5: Compute shear strength of soils based on shear parameters obtained from shear tests.*

*CO6: Check stability of slopes incorporating relevant soil parameters*

### **15CE54 WASTE WATER ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### **ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

*At the end of this course the student will be able to*

*CO1: Recognize the origin and importance of effective conveyance of domestic sewage.*

*CO2: Summarize the perspectives of various house drainage systems.*

*CO3: Demonstrate not only the physico-chemical and bio-chemical characteristics of domestic sewage; but also deploy the appropriate conventional treatment schemes.*

*CO4: Illustrate the employability of appropriate biological treatment schemes.*

*CO5: Recognize the current need for membrane technologies in achieving the recycling of treated effluents.*

### **15CE55 IRRIGATION ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### **ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

*At the end of this course the students will be able to*

*CO1: Compute the demand and the available quantity of water required for irrigating a given crop area*

*CO2: Determine the yield of a well*

*CO3: Produce hydraulic and geometrical design of storage and distribution systems to supply water for a given area*

*CO4: Demonstrate suitable techniques for the construction and maintenance of a reservoir and a canal network*

*CO5: Design, operate and maintain a canal*

*CO6: Plan and develop a procedure to implement an irrigation project given an agricultural command area*

### **15CE57 HIGHWAY ENGINEERING LABORATORY**

**ASSESSMENT: PRACTICAL**

**COURSE OUTCOMES:**

*After successful completion of the course, student will be able to*

*CO1: Determine the properties of Coarse aggregate related to highway requirements for laying pavement*

*CO2: Evaluate the properties of Bitumen related to flexible pavement*

### **15CE58 ENVIRONMENTAL ENGINEERING LABORATORY**

**L T P C**

**0 0 4 2**

**ASSESSMENT: PRACTICAL**

**COURSE OUTCOMES:**

*At the end of this course the students will be able to*

*CO1: Ascertain the suitability of water samples for drinking and construction purpose.*

*CO2: Ascertain the suitability of wastewater samples as per effluent standards.*

*CO3: Select the degree of treatment based on the results of water samples.*

*CO4: Select the degree of treatment based on the results of the wastewater samples.*

### **15CE61 STRUCTURAL ANALYSIS II**

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

**ASSESSMENT: THEORY**

**COURSE OUTCOMES:**

*At the end of this course the students will be able to*

*CO1: Analyze statically indeterminate structures by slope deflection method.*

*CO2: Analyze continuous beams and plane frames using moment distribution method.*

*CO3: Formulate flexibility matrix and apply to determinate and indeterminate structures.*

*CO4: Formulate stiffness matrix and apply to determinate and indeterminate structures.*

*CO5: Outline the basic concepts, applications and limitations of FEM.*

**15CE62 DESIGN OF STEEL STRUCTURES**

**ASSESSMENT: THEORY**

**COURSE OUTCOMES:**

*After successful completion of the course, student will be able to*

*CO1: Describe the Working Stress Method and Limit State Method design concepts*

*CO2: Design the bolted and welded connections*

*CO3: Design the tension members as per IS code and concepts of shear lag*

*CO4: Design the compression members as per IS code*

*CO5: Design the laterally supported and unsupported beams as per IS code*

*CO6: Analyze statically indeterminate beams and portal frames using plastic theory*

**15CE63 FOUNDATION ENGINEERING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**ASSESSMENT: THEORY**

**COURSE OUTCOMES:**

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

*CO1: Understand types of foundation and collect required data for selection of foundation through suitable soil investigations*

*CO2: Compute Bearing Capacity of soils and settlements of foundations.*

*CO3: Plan suitable methods to reduce settlements and increase Bearing Capacity.*

*CO4: Compute load carrying capacity and settlement of pile and pile groups.*

*CO5: Check the stability of retaining walls by understanding theories of earth pressure*

*CO6: Assess weak ground characteristics and suggest different ground improvement alternatives.*

**15CE64 DESIGN OF REINFORCED CONCRETE STRUCTURES**

L	T	P	C
2	2	0	3

**ASSESSMENT: THEORY**

**COURSE OUTCOMES:**

*At the end of this course the students will be able to*

*CO1: Understand the concepts of yield line theory.*

*CO2: Design retaining walls*

*CO3: Analyse Building frames for gravity and wind loads*

*CO4: Design water tanks using working stress method*

**15CE67 QUANTITY SURVEYING AND PROJECT PLANNING**

L	T	P	C
0	0	4	2

**ASSESSMENT: PRACTICAL**

**COURSE OUTCOMES:**

*At the end of this laboratory, the students will be able to*

*CO1: List items of work and prepare specifications.*

*CO2: Prepare the detailed estimate and abstract to arrive the quantity of items of work.*

*CO3: Estimate the cost and quantity of materials and Resources for items of work.*

*CO4: Evaluate the value of existing civil engineering structures and project planning tools.*

**15CE68 SOIL MECHANICS LABORATORY**

L	T	P	C
0	0	4	2

**ASSESSMENT: PRACTICAL**

**COURSE OUTCOMES:**

*At the end of this laboratory, the students will be able to*

*CO1: Prepare soil samples for testing, performing the test, collecting and analyzing data*

*CO2: Practice common soil tests to identify physical and mechanical properties of soils*

*CO3: Demonstrate the ability to write clear technical reports*

*CO4: Apply the laboratory results to problem identification and basic soil mechanics related design problem*

### **15CE71 CONSTRUCTION MANAGEMENT**

#### **ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

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

*CO1 : Apply business and management practices in planning for resources of a construction project.*

*CO2: Employ the procedure for contractors selection through tendering process.*

*CO3 : Develop a realistic schedule for the optimum use of resources in construction projects.*

*CO4 : Prepare construction project estimates and exhibit construction accounting and cost control techniques.*

*CO5 : Develop and demonstrate leadership, teamwork, motivation and communication skills.*

### **15CE72 ENGINEERING ECONOMICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

#### **ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

*Upon successful completion of this course, students will be able to*

*CO1: Recognize the fundamental economic concepts applicable to engineering.*

*CO2: Find the techniques of incorporating inflation factor in economic decision making.*

*CO3: Apply the basics of economics and cost analysis to engineering.*

*CO4: Identify economically sound decisions.*

### **15CE73 EARTHQUAKE RESISTANT DESIGN OF STRUCTURES**

#### **ASSESSMENT: THEORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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#### **COURSE OUTCOMES:**

<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
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*At the end of this course the students will be able to*

*CO1: Explain the concepts of structural dynamics*

*CO2: Explain the elements of engineering seismology and behaviour of structures in past earthquakes*

*CO3: Analyze structures by static and dynamic methods to determine seismic parameters as per Indian Standards*

*CO4: Design the beams, columns, joints, connections and shear walls for earthquake forces as per Indian Standards*

*CO5: Illustrate ductile detailing of structural elements as per Indian Standards*

*CO6: Design the masonry structures as per Indian standards and concept of base isolation*

### **15CE74 PRESTRESSED CONCRETE STRUCTURES**

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

#### **ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

*At the end of this course the students will be able to*

*CO1: Explain the concepts of Prestress and determine the losses in prestressed concrete members due to shrinkage, creep, relaxation and friction*

*CO2: Design of prestressed concrete beams or flexure and shear using Limit State method of Design and Check for deflection*

*CO3: Design of end blocks, tension and compression members*

*CO4: Design of composite prestressed concrete beams and shear connectors.*

*CO5: Analyze the continuous prestressed concrete beams*

*CO6: Discuss the concept of partial and circular prestressing*

### **15CE76 COMPUTER APPLICATIONS LABORATORY**

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

#### **ASSESSMENT: PRACTICAL**

#### **COURSE OUTCOMES:**

*At the end of this laboratory, the students will be able to*

*CO1: Modeling, Analysis and Design of frames and trusses using STAAD Pro*

*CO2: Modeling, Analysis and Design of Bridge decks for moving loads using STAAD Pro*

*CO3: Modeling, Analysis and Design of circular and rectangular water tanks using STAAD Pro*

*CO4: Design of slab, beams, columns & Footings using EXCEL*

## 15CE77 CONCRETE LABORATORY

L	T	P	C
0	0	4	2

### ASSESSMENT: PRACTICAL

#### COURSE OUTCOMES:

*At the end of this course the students will be able to*

*CO1: Assess the properties on fresh and hardened concrete.*

*CO2: Compute the mix design for the required grade of concrete as per Indian Standard codes of practice.*

*CO3: Evaluate the properties of materials under various loading conditions such as tension, compression and bending.*

*CO4: Assess the properties of hardened concrete by performing NDT tests*

## **19CEM31 DIFFERENTIAL EQUATIONS AND BOUNDARY VALUE PROBLEMS**

**(Common to CIVIL and CHEMICAL Branches)**

**ASSESSMENT: THEORY**

### **COURSE OBJECTIVE**

*The intent of the course, students will be expected to*

- *Demonstrate their understanding ordinary differential equations and partial differential equations*
- *Incorporate the concepts of numerical methods required for solving ordinary differential equations and partial differential equations*

### **COURSE OUTCOMES:**

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

**CO1:** Analyze the concepts of ordinary differential equations in modelling and solving physical problems

**CO2:** Demonstrate accurate and efficient use of numerical solutions of ordinary differential equations and their role in modern mathematics and applied contexts

**CO3:** Formulate concrete problems and finding the solutions of partial differential equations

**CO4:** Solve the boundary value problems relevant to vibration of strings

**CO5:** Familiarize finite difference approximation to get numerical solutions of partial differential equations

## **19CE31 - MECHANICS OF SOLIDS**

**ASSESSMENT: THEORY**

### **COURSE OUTCOME**

After successful completion of the course, students will be able to

**CO1:** Compute the centroid of given plane and composite sections and calculate the moment of inertia, principal moment of inertia for a given plane sections.

**CO2:** Compute simple stress and strain, thermal stresses for the given linear bars and compound bars with single axial load also calculate the change in volume of given three dimensional bars subjected to three mutually perpendicular forces.

**CO3:** Compute principal stresses for the given two dimensional stress systems and calculate stresses for the given material due to suddenly applied load and impact load.

**CO4:** Compute and construct shear force, bending moment diagrams for the given determinate beams subjected to Point loads, UDL and UVL.

**CO5:** Compute stresses related to bending and shear for the given determinate beams with different cross sections subjected to Point loads and UDL and also compute bending and shear stress of given hollow and solid circular shaft.

## **19CE32 - ENGINEERING GEOLOGY**

**ASSESSMENT: THEORY**

### **COURSE OUTCOME**

After successful completion of the course, students will be able to

**CO 1:** Describe the importance of geology in civil engineering, weathering, type of soils, geological work of various geological agents, earthquake, interior and age of the earth, landslide mitigation.

**CO 2:** Explain geological surface and subsurface features

- CO 3:** Identify the elements of crystallography to classify minerals based on their system
- CO 4:** Identify minerals based on their physical properties and its distribution in India.
- CO 5:** Identify rocks based on mineralogy, texture, structure and mode of occurrence with its application in civil engineering purposes.
- CO 6:** Employ the geological knowledge for projects of dams & reservoirs, tunnels, coastal protection.
- CO 7:** Interpret subsurface geological features and properties of rocks using fundamental principles of geophysical methods.

### **19CE33 - MECHANICS OF FLUIDS**

**ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

On successful completion of this course, students will have the ability to

- CO1:** Apply the storage and flow concepts of fluids and pressure acting on fluids
- CO2:** Apply the principles of static conditions on fluids
- CO3:** Analyse the principles of fluid flow using measuring devices
- CO4:** Analyse simple pipe systems for transport of liquids under different flow conditions
- CO5:** Apply the principles of dimensional analysis in solving fluid problems through model studies

### **19CE34 SURVEYING**

**ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

After successful completion of the course, students will be able to

- CO1** - Assess the angles, distances and levels
- CO2** - Identify the data collection methods and prepare field notes
- CO3** - Demonstrate the application of survey instruments
- CO4** - Interpret the survey data and compute areas and volumes
- CO5**- Describe the principles of photogrammetry and hydrographic surveying

### **19CE35 - WATER SUPPLY ENGINEERING**

**ASSESSMENT: THEORY**

#### **COURSE OUTCOME**

After successful completion of the course, students will be able to

- CO1:** Identify the various sources and characteristics of water and analyse the importance and demand for planned water supply system.
- CO2:** Analyse the need and economic feasibility in the conveyance of potable water from the source using pipes and pumps.
- CO3:** Design various conventional treatment system to achieve the potable water quality standards specified.
- CO4:** Interpret advanced water treatment system available in current scenario to provide high quality drinking water.
- CO5:** Describe the basic requirements of water distribution system and determine the pipe flow rates and pressure heads using pipe network analysis.

### **19CEL36 - STRENGTH OF MATERIALS LABORATORY**

**ASSESSMENT: PRACTICAL**

#### **COURSE OUTCOME**

After successful completion of the course, students will be able to

**CO1** : Assess the tensile and shear strength of mild steel rod and compressive strength, water absorption and efflorescence of given bricks.

**CO2** : Assess the hardness number of given metal pieces.

**CO3**: Assess the impact strength of given metal and stiffness of helical spring.

**CO4**: Assess the compressive strength and hardness properties of wooden specimens.

**CO5** : Assess the flexural rigidity and modulus of elasticity of simply supported beams with rectangular, semi circular and trapezoidal cross section, fixed beam and cantilever beam of square cross section.

### **19CEL37 SURVEY LABORATORY**

#### **ASSESSMENT: PRACTICAL**

#### **SURVEYING LABORATORY**

**Course Outcomes:** After successful completion of the course, students will be able to

**CO1** – examine the measurements of distance, area, angles, and levels

**CO2** - evaluate the cutting and filling quantities

**CO3** – determine the setting out works of buildings, bridges and other structures

### **19CE41 - CONSTRUCTION TECHNOLOGY**

#### **ASSESSMENT: THEORY**

#### **COURSE OUTCOME**

After successful completion of the course, student will be able to

**CO1:** Understand building components and its construction process.

**CO2:** Demonstrate the types of brick and stone masonry

**CO3:** Describe types of roofs and floors

**CO4:** Classify the different types of staircases based on geometrical configurations, doors and windows.

**CO5:** Describe the requirements for fire safety, thermal and sound insulation in a building.

### **19CE42 -STRENGTH OF MATERIALS**

#### **ASSESSMENT: THEORY**

#### **COURSE OUTCOME**

After successful completion of the course, student will be able to

**CO1:** Determine slope and deflection of statically determinate beams subjected to Point load and UDL.

**CO2:** Sketch Shear force and bending moment diagram for the given statically indeterminate beams subjected to Point load and UDL.

**CO3:** Compute the stresses due to combined bending and axial load for short column and critical load calculation in long columns

**CO4:** Compute stresses in thin, thick cylinders subjected to fluid pressure and member forces in simple plane roof trusses.

**CO5:** Calculate the stresses due to unsymmetrical bending in the symmetrical and unsymmetrical sections and locate the shear centre for thin walled open sections with one axis of symmetry.

### **19CE43 TRANSPORTATION ENGINEERING**

#### **ASSESSMENT: THEORY**

#### **COURSE OUTCOMES:**

After successful completion of the course, student will be able to

**CO1:** Interpret the types of Indian roads, organizations and pavements

**CO2:** Design the geometrical components for Indian roads

**CO3:** Demonstrate the organizational set up and features of Indian Railways

**CO4:** Design the components of permanent way in Railway Stations

**19CE44 - APPLIED HYDRAULICS AND HYDRAULIC MACHINERY**

**ASSESSMENT: THEORY**

**COURSE OUTCOME**

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

**CO1:** Obtain hydraulically best section for uniform flow in open channel and find the flow parameters through notches, weirs and flumes.

**CO2 :** Compute the flow characteristics of non-uniform flow in open channels based on geometrical and flow parameters.

**CO3 :** Analyse relative and absolute velocity on flat and curved vanes in rest and motion.

**CO4 :** Evaluate the performance tests on different types of hydraulic turbines.

**CO5 :** Estimate the performance parameters of different pumps and its applications.

**19CE45- WASTE WATER ENGINEERING**

**ASSESSMENT: THEORY**

**COURSE OUTCOME**

At the end of this course, the student will be able to

**CO1:** Recognize the origin and importance of effective conveyance of domestic sewage.

**CO2:** Analyse the hydraulic components of sewage and design sewers including sewage pumping stations.

**CO3:** Summarize the perspectives of various house drainage systems.

**CO4:** Demonstrate the physico-chemical and bio-chemical characteristics of domestic Sewage and also deploy the appropriate conventional treatment schemes.

**CO5:** Design sludge digesters and also to justify the effluent disposal standards and sludge disposal.

**19CE46 PROFESSIONAL PRACTICE AND ETHICS**

**ASSESSMENT: THEORY**

**COURSE OUTCOMES:**

After successful completion of the course, student will be able to

**CO1:** Acquire the knowledge of Building by laws and regulations and plan approval methods

**CO2:** Perform and establish approval process for any type of buildings including electrical supply and water supply.

**CO3:** Able to execute the Fundamentals for establishment of individual firms, registration with government agencies and membership in professional bodies.

**CO4:** Able to perform documentation and preparation of bills from commencement till the closure of the project.

**CO5:** Perform ethics and fundamentals in establishing professional practice with social responsibility.

**19CEL47 HYDRAULICS LABORATORY**

**ASSESSMENT: PRACTICAL**

**COURSE OUTCOMES:**

**CO1:** Examine the flow meters through venturimeter and Orifice meter and the losses of flow of water through pipes.

**CO2:** Compute the rate of flow of water from a tank and in an open channel

**CO3:** Examine the Bernoulli's theorem for varying cross section of pipe flow.

**CO4:** Determine the metacentric height of the model of the ship in hydrostatic condition.

**CO5:** Find the performance of centrifugal, reciprocating pumps, Pelton and Francis turbines through characteristics curves.

**19CEL48 ENVIRONMENTAL ENGINEERING LABORATORY**

**ASSESSMENT: PRACTICAL**

**COURSE OUTCOME**

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

**CO1** : Ascertain the suitability of water samples for drinking and construction purpose.

**CO2** : Ascertain the suitability of wastewater samples as per effluent standards.

**CO3** : Select the degree of treatment based on the results of water and wastewater samples.

Programme Name	Course Name	Program specific outcomes and course outcomes
B.E (CSE)	Linear Algebra, Fourier Transforms and Partial Differential Equations	CO1 : To discuss linear transformations, matrix operations for solving linear systems and to find rank and dimensions.
		CO2 : To discuss vector spaces and their properties and use Gram Schmidt process for orthogonalisation
		CO3 : To find infinite and finite Fourier transforms of standard functions and study the properties
		CO4 : To formulate and solve the partial differential equations of linear and non-linear with standard techniques of higher order
	Automata Theory and Discrete Mathematics	CO1 : Apply logical reasoning in verifying the correctness and validity of simple instances of valid logical arguments.
		CO2 : Design encoding and decoding procedures for error detection and correction.
		CO3 : Knowledge in constructing system models which are the natural extension of Automata that are used to devise design procedures.
		CO4 : Discuss and deploy specification of languages using grammars
	Data Structures and Algorithms-I	CO1 : Learn the fundamental data structures such as lists, stacks, queues, trees, graphs and associated algorithms
		CO2 : Choose the Data Structures and Algorithms that are appropriate for different applications
		CO3 : Analyze the computational complexity of computer algorithms
	Computer Architecture	CO1 : Demonstrate the working of the algorithm for performing arithmetic operations, using the registers and ALU within the processor
		CO2 : Illustrate the control sequences and draw data flow path during the instruction execution.
		CO3 : Discuss the concept of pipelining and examine hazards and techniques to enhance the performance of the system.
		CO4 : Given a memory module specifications, choose the appropriate memory mapping procedure to enhance the performance of the system
		CO5 : Discuss the communication of I/O interface and ports with the processor

	Object Oriented Programming and Java	CO1 : Identify classes and objects in software applications.	
		CO2 : Design objects for specific applications in java.	
		CO3 : Demonstrate the concepts of multithreading, java networking, applet and its use.	
	Electrical Machines	CO1 : The students will able to label the parts and explain the construction and working principle of DC machines and single phase Transformers.	
		CO2 : The students will able to analyze the performance of alternator and three phase induction motor for different loading conditions.	
		CO3 : The students will be able to understand the operating principle of special machines.	
		CO4 : Design -The students will be able to explain the electric drive system with AC and DC motors and to design the converter fed DC drive and variable frequency AC drive using inverter.	
		CO5 : Evaluate - The students can be able to identify the suitable motors and drives for particular application.	
	Science of Creativity and Professional Ethics	CO1 : Describe the principles of karma yoga and functioning of mind and consciousness.	
		CO2 : Hypothesize the evolution of Universe and living beings in a global and societal context	
		CO3 : Infer the principles of Yoga to practice it and know the value of health	
		CO4 : Interpret the philosophy of introspection procedures for better living	
		CO5 : Assess, take personal responsibility and follow professional ethics for sustained growth in career and life	
Object Oriented Programming lab	CO1 : Create effective java applications using fundamental object oriented programming concepts.		
	CO2 : Demonstrate advanced java concepts like Exception handling, Multithreading and Applets.		
	CO3 : Design and develop java applications for real world problems		
Electrical Machines Laboratory	CO1 : The students will be able to find the performance parameters and draw the electrical and mechanical characteristics of DC and AC machines.		

		CO2 : The students will be able to understand the working of controller for stepper and servo motor and draw the pulse waveforms for given duty cycles.
		CO3 : The Students will be able to determine the transfer function of DC and AC servo motor.
		CO4 : The students will be able to understand the speed control of DC and AC motors by using power electronic converters.
		CO5 : The students will be able to develop simulation circuits for speed control of DC and AC motors using various power electronics circuits.
	Numerical Methods, Statistics and Random Processes	CO1: To Summarize the concepts of numerical methods in solving linear system of equations using Gaussian methods. Also to discuss standard methods to solve ordinary differential equations
		CO2:To analyze and study various methods to solve partial differential equations numerically
		CO3:To discuss two-dimensional random variables and their properties. Also to discuss curve fitting with least square technique
		CO4:To demonstrate the concepts of sampling theory with various hypothetical testing
		CO5: To analyze the classification of random processes with standard measures
	Data Structures and Algorithms-II	CO1 : Explain the various file organization and access methods
		CO2 : Analyze sorting, searching algorithms with their complexities and their application to real world problems
		CO3 : Describe various memory management algorithms as used in different operating Systems
		CO4 : Choose the appropriate data structure and algorithm design method to implement real world problems
	Operating Systems	CO1 : Outline the basic functionalities of operating systems, operating system components, various types of operating system and system software.
		CO2 : Apply process scheduling, processes synchronization, deadlock algorithms to demonstrate process execution.
		CO3 : Examine various memory management schemes and find suitable technique to design the system

		CO4 : Describe disk scheduling algorithms, Secondary storage management techniques for better utilization of external memory and identify the file organization and access methods
	Database Management systems	CO1 : Knowledge in basic concepts and the architecture of database management systems, data models, relational database theory and the features of SQL queries.
		CO2 : Master the sound design principles of logical design by using ER modeling and normalization concepts.
		CO3 : Knowledge in transaction processing concepts, Concurrency Control mechanism and Database Recovery methods and the ability to apply the concepts in the design of Database applications.
		CO4 : Ability to use different Database Storage structures, access techniques and Indexing methods in Database applications
	Electronic Circuits	CO1:Examine semiconductor diode characteristics and design rectifiers, voltage regulator and wave shaping circuits
		CO2: Analyze the characteristics and biasing of BJT and FET based on the configuration and categorize the level of impedance and gain
		CO3: Construct the different classes of large signal amplifiers to calculate their efficiencies
		CO4: Analyze and Compare the amplifiers with and without feedback using BJT and FET
		CO5: Categorize Transistors and Identify an appropriate choice for an application
	Engineering Mechanics and Strength of Materials	CO1: The students will be able to analyze of statically determinate trusses by method of joints, method of sections and tension coefficient method
		CO2:The students will be able to analyze parabolic cables subjected to udl and point load
		CO3:The students will be able to compute stress and strain, thermal stresses
		CO4:The students will be able to practice Shear Force and Bending Moment computations and construct shear force and bending moment diagram for determinate beams.

		CO5: The students will be able to compute stresses related to torsion
		CO6: The students will be able to explain kinetics and kinematics of particles using equations of Motion
	Data Structures and Algorithms Laboratory	CO1 : Selection and application of suitable data structures in implementing practical problems.
		CO2 : Apply searching and sorting algorithms that suit the given problem statement
		CO3 : Identify suitable graph based algorithms and apply them for solving problems that arise in real world scenarios
	Database Management Systems Laboratory	CO1 : Practice various DDL, DML, TCL commands so as to perform various database operations and solve queries for given application.
		CO2 : Demonstrate open database connectivity by establishing connections between front end and databases
		CO3: Experiment various PL/SQL features such as procedures, functions, triggers and report generation.
	Electronic Circuits Laboratory	CO1: Construct wave shaping and rectifier circuits using semiconductor diodes for evaluating ripple factor and determine transistor parameters from the input & output characteristics of Diodes, BJT, UJT & FET
		CO2: Design and test the different types of biasing circuits for given specifications and calculate the stability factors & analyze the frequency response of different types of single stage BJT amplifiers and calculate the gain and bandwidth
		CO3: Design and test Oscillators, Multivibrators, Schmitt triggers using Transistors and opamp
		CO4: Develop communication skills and capability to work in teams
	Data Communication	CO1 : Summarize different analog and digital transmission techniques.
		CO2 : Discuss the types of Multiplexing and switching techniques for Data Communication
		CO3 : Apply various error detection and correction mechanisms to maintain data accuracy.

		CO4 : Describe the various technologies used in wired networks with their applications
		CO5 : Explain the different generations of cellular networks and various Satellite Communications
	Computer Networks	CO1 : Describe the layered architecture of computer networks, factors influencing the performance of networks and discuss the various flow control mechanisms.
		CO2 : Discuss IP address range for subnets and routing protocols used in computer networks
		CO3 : Demonstrate the working of IP, TCP and UDP protocols.
		CO4 : Discuss the services of application protocols and develop applications for client server model using socket functions
	Unix Internals	CO1 : Outline the architecture of Unix Operating System and the internal operations of file system and process management.
		CO2 : Discuss Allocation of Disk Blocks and Manipulation of inode for process and File Management.
		CO3 : Examine Process Scheduling and memory management strategies on Unix Operating System.
		CO4 : Summarize the working Methodology of various IPC Mechanisms and device driver Interfaces
	Software Engineering	CO1 : Describe the various software life cycle models and choose an appropriate model for a given application.
		CO2 : Identify the functional requirements, apply data flow, ER diagrams and prepare Software Requirement Specifications
		CO3 : Employ architectural styles, software design methodologies, coding standards in developing practical applications
		CO4 : Identify suitable testing techniques and design test cases for the software modules.
		CO5 : Estimate effort, prepare project schedules and Plans, monitor and Control project activities
	Microprocessor and interfacing	CO1: Describe the internal architecture of a processor
		CO2 : Write assembly language programs and analyze their performance

		CO3 : Describe the interface for peripheral devices to microprocessor
		CO4 : Outline the concepts of pipelining and multitasking in Pentium processor
	Distributed systems	CO1 : Discuss the challenges and issues in applying various distributed system models in real time applications
		CO2 : Demonstrate interprocess communication using Remote Method Invocation and Remote Procedure Call
		CO3 : Describe the architecture and security provided by OS layer to support Distributed System.
		CO4 : Identify the design issues related to naming services, synchronization and use synchronization algorithms in various distributed system scenarios.
		CO5 : Classify various consistency models and describe the approaches to achieve fault tolerance in distributed environment.
	Open source systems	CO1 : State the various open source Licenses and understand the Linux build systems.
		CO2 : Discuss the configuration of Apache web servers and Describe the Basic concepts of Model Driven Architecture.
		CO3 : Illustrate the concept of NoSQL Database and to Choose the Appropriate No-SQL Data Base Types
		CO4 : Demonstrate ability to learn and use programming language/scripts (such as PHP & Python) to Develop simple applications.
	Graphics and Multimedia	CO1 : Demonstrate the working of graphics output primitive algorithms, clipping algorithms and apply two dimensional geometric transformations
		CO2 : Illustrate three dimensional object representation, transformations and concepts involved in spline representation.
		CO3 : Describe the Multimedia concepts, its architecture and its real world applications
		CO4 : Construct various Multidimensional index structures and identify suitable file format standard for the efficient storage of Multimedia data.
		CO5 : Explain various compression techniques for the efficient transmission of Multimedia data

	Networks Laboratory	CO1 : Implement different models of servers using Socket functions. CO2 : Simulate the working of protocols used in different layers of networks.
	Operating Systems Laboratory	CO1 : Knowledge in using different system and I/O calls, UNIX commands and shell programming CO2 : Demonstrate Inter process communication, algorithms for process scheduling, memory management and process synchronization
	Microprocessor Laboratory	CO1 : Develop assembly language programs and analyze their performance. CO2 : Design interfaces for peripheral devices to microprocessors
	Mini Project	CO1 : Apply computing algorithms and techniques in designing simple solutions and examine the outcome of real- time projects. CO2 : Integrate various interdisciplinary areas to enhance domain knowledge. CO3 : Develop technical skills in providing feasible solutions for real-life problems and enhance technical writing ability CO4 : Demonstrate effective communication and collaborative working in peer groups
	Resource Management Techniques	CO1:Describe optimization problems using Linear and dynamic programming, queuing theory and scheduling. CO2:Apply the knowledge gained on simulation, queuing theory and scheduling methods to provide optimum solution for common business problems. CO3: Determine the replacement policies for better replacement of resources at right time.
	Data Warehousing and Data mining	CO1 : Describe the basic concepts, modeling, architectures of data warehouse and sketch different Data warehouse schema for the given real world applications CO2 : Demonstrate the multidisciplinary fields of data mining and illustrate the techniques for data preprocessing.

		CO3 : Find frequent item set and generate association rules for the given transactions and analyze the performance of different association rule mining algorithms
		CO4 : Analyze different types of data using classification and clustering techniques
		CO5 : Discuss mining of various complex data types like text, Web, multimedia, time-series, and spatial data
	Artificial Intelligence	CO1 : Illustrate real world problems from the perspective of intelligent agents to achieve problem oriented goal
		CO2 : Apply various informed search strategies in optimal decision making
		CO3 : Employ first order logic for building knowledge base to infer reasoning using knowledge engineering
		CO4 : Express different plans to deal with problems and describe knowledge representation and reasoning of uncertain domain
		CO5 : Describe several learning algorithms to improve the performance of intelligent agents
	Embedded real time systems	CO1 : Analyze Processor's power consumption in various modes and write optimized code for embedded systems development
		CO2 : Demonstrate the Scheduling of given set of real-time tasks using the appropriate scheduling algorithms
		CO3 : Examine the characteristics of real-time databases and real-time communications
		CO4 : Outline embedded software testing process
		CO5 : Design and develop simple embedded applications
	Object oriented analysis and design	CO1 : Describe the fundamental aspects of Object Models
		CO2 : Identify classes and Objects and establish relationship among objects and classes and objects.
		CO3 : Selection and Application of appropriate object oriented design Methodologies in real world applications
		CO4 : Construct Class, Use Case and Interaction Diagrams for software specifications

		CO5 : Illustrate the object-oriented software development process and work flow
	Mobile computing	CO1 : Identify the strength, limitations of mobile networks and discuss the technologies for mobile communication.
		CO2 : Describe the basic working principle of Mobile IP and express different scenarios for performing mobile communication.
		CO3 : Analyze TCP variations for mobility support and discuss about WAP architecture.
		CO4 : Explain different types of data dissemination and synchronization mechanisms for mobile computing
		CO5 : Develop simple android mobile application using development tools
	Internet of Things	CO1 : Describe the challenges for Smart objects, architecture and paradigms for Internet of things
		CO2 : Demonstrate knowledge of MAC & routing protocols developed for Low Power and Lossy Networks.
		CO3 : Discuss the concepts and implementation of CoAP
		CO4 : Assess the different IOT technologies and select suitable solutions for an application.
	Software Engineering Laboratory	CO1 : Identify and analyze the requirements using CASE tools
		CO2 : Develop the design of software using CASE tools
		CO3 : Write Test cases and conduct manual and automated testing of software using testing tools
		CO4 : Estimate project scheduling and tracking using project management tool
	Embedded Systems Laboratory	CO1 : Develop Embedded C programs using different embedded IDE
		CO2 : Develop applications based on IoT and sensors
	Soft Skills Development	CO1 : Specify appropriate responses and construct summary for the given long speeches, news, programmes, discussions, conversation over Television & Radio, TED talks and podcasts.
		CO2 : Demonstrate Project Communication, Documentation and Report writing skills and ability to write job applications..

		CO3 : Specify appropriate responses for the given mock tests(IELTS,TOEFL,GRE).
		CO4 : Set Career goals and formulate strategies by Prioritizing, organizing and scheduling the required tasks
		CO5 : Asses the problem, analyze the approaches of team members and devise solutions to resolve the conflict.
	Web Technology	CO1 : Identify working model and learn basic web concepts to develop Static and Dynamic web pages
		CO2 : Demonstrate an ability to use static and dynamic web page design techniques to construct an interactive web pages using Client/Server side technologies.
		CO3 : Demonstrate use of Ruby on Rails framework in developing interactive web applications
		CO4 : Understand and discuss the concepts in e-business models and e-marketing.
	Principles of Compiler Design	CO1 : Cite and Explain with example the analysis aspects of compiler analysis and synthesis Phases.
		CO2 : Design of Compiler aspects using LEX and YACC tool.
		CO3 : Demonstrate their understanding by solving problems.
	Information Storage Management	CO1 : Describe Data Centre Infrastructure, various storage technologies and disk performance.
		CO2 : Discuss Intelligent Storage Systems, Analyze and implement RAID solutions
		CO3 : Analyze Storage Attached Networks and Network Attached Storage technologies and identify suitable solutions for practical applications.
		CO4 : Describe Content Addressed Storage and storage virtualization techniques.
		CO5 : Compare different backup, restoration and replication methods and select suitable solutions to ensure business continuity.
	Customer Relationship Management	CO1 : State the evolution of marketing and define CRM architecture explaining customer acquisition, retention and segmentation.

		CO2 : Describe the business value, its costs and deploying data mining for CRM with proper guidelines for privacy.
		CO3 : Demonstrate the scoring process and apply the various CRM optimization techniques to optimize CRM process in order to improve customer profitability.
		CO4 : Evaluate CRM tools using tool assessment and methodology to choose the appropriate tool for real time applications.
	Cloud and virtualization	CO1 : Recognize the need for cloud computing and state the services and building blocks of cloud computing environments.
		CO2 : Define and classify the virtualization and its techniques
		CO3 : Illustrate the cloud architecture and discover the requirement in industries.
		CO4 : Analyze the major security challenges and privacy problems in the cloud and virtual environment.
	Compiler Laboratory	CO1 : Describe the usage of LEX and YACC tool
		CO2 : Practice experiments using LEX and YACC tool
		CO3 : Demonstrate ability to design a simple compiler for a given grammar using Lex and Yacc.
	Web Programming Laboratory	CO1 : Identify working model and learn basic web concepts to develop Static and Dynamic web pages.
		CO2 : Demonstrate an ability to use static and dynamic web page design techniques to construct an interactive web pages using Client/Server side technologies
		CO3 : Demonstrate use of Ruby on Rails framework in developing interactive web applications.
		CO4 : Understand and discuss the concepts in e-business models and e-marketing.
	Industrial Economics and Corporate Management	CO1: Given an economic case study or problem analyze the demand and supply and sketch a demand and supply curve
		CO2: For given stock market analysis identify, and devise investment plan,

		CO3: Given an inflation rate of India, analyze and specify the causes and provide the solution to each cause
		CO4: For a job requirement formulate the steps involved in a selection process as a chart and interpret it
		CO5: For a given scenario write the procedure to file a patent for a product in India or abroad
	Cryptography and Network Security	CO1 : Apply the symmetric key encryption algorithms to solve the security attacks and threats
		CO2 : Compute the cipher text from the given plaintext using public key cryptography.
		CO3 : Describe the concepts of key management and authentication techniques
		CO4 : Select suitable Intrusion detection system and Firewall to prevent intrusion
		CO5 : Use of hashing and message authentication concepts to generate digital signature and certificates
	Enterprise Resource Planning Concepts	CO1 : Describe the operational aspects of ERP system and its related technologies
		CO2 : Demonstrate the steps required for ERP Project management and implementation process by choosing the right vendors/consultants, employee training and monitoring
		CO3 : Categorize the business modules of an ERP package in order to define the functionality of various departments in a company.
		CO4 : Analyze the ERP marketplace and its vendors, and assess how Enterprise Application Integration (EAI), e-business help the company use ERP to its utmost benefit.
	Wireless Sensor Networks	CO1 : Describe the sensor network architecture and its applications.
		CO2 : Describe the different protocols used in wireless sensor networks and their applications.
		CO3 : Outline the features of OS and performance models of wireless sensor networks
	Digital Forensics	CO1 : Discuss various applications of computer forensics.
		CO2: Describe the fundamentals of Computer Forensics its related technologies and services.

		CO3 : Demonstrate the skills for collecting digital evidence and analyze using Forensic Analysis techniques.
		CO4:Illustrate the investigative measures and surveillance tools used in forensics applications.
	Internet of Things	CO1 : Identify the strength, limitations of mobile networks and discuss the technologies for mobile communication.
		CO2 : Describe the basic working principle of Mobile IP and express different scenarios for performing mobile communication.
		CO3 : Analyze TCP variations for mobility support and discuss about WAP architecture.
		CO4 : Explain different types of data dissemination and synchronization mechanisms for mobile computing
		CO5 : Develop simple android mobile application using development tools
	Project Phase-II	CO1 : Apply algorithm and design techniques in the project and experience their outcome in their own real time project scenario
		CO2 : Develop the management skills to achieve the project goal by working as a team and enhance technical writing skills
		CO3 : Examine mathematical techniques in various fields for solving computer engineering problems.
		CO4 : Working with various interdisciplinary projects to extend the teams domain knowledge.
		CO5 : Demonstrate the technical skills acquire to provide feasible solution for real-life problems
	CO6 : Effectively communicate and collaboratively work with in peer groups to develop optimized hardware/software solutions	

**PROGRAM OUTCOME**

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problem

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive

clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**PROGRAM SPECIFIC OUTCOME**

PSO1 : Design and develop effective solutions based on cutting-edge hardware and software that combine creativity and performance.

PSO2 : Apply algorithmic thinking and computing concepts in interdisciplinary domains with a focus on societal needs and challenges.

# COIMBATORE INSTITUTE OF TECHNOLOGY

## DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

### PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

#### (POs & PSOs)

Students in the Department of Electronics and Communication Engineering program at the time of their graduation should be in possession of :

- PO1. knowledge in mathematics, science, and engineering fundamentals to solve complex problems in the domain of Electronics and Communication engineering
- PO2. identify, formulate and analyze complex engineering problems in real world using principles of science and engineering for conceptualizing engineering models
- PO3. design solutions for complex engineering problems and design system components for a given specification with appropriate consideration for the public health and safety, economic, political, societal and environmental considerations
- PO4. apply appropriate techniques and tools, design, conduct experiments, analyze and interpret data to demonstrate and view things in a broader perspective either individually or in group(s).
- PO5. apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO6. introducing new competitive features in electronic hardware and software systems on behalf of human Synthesize complex electronic hardware and software systems for human needs
- PO7. to understand and relate the effect of engineering solutions materialistically ,economically and socially
- PO8. understand and commit to professional ethics with social responsibilities and standard engineering practices
- PO9. ability to work effectively as both an individual and in diverse teams on multidisciplinary environments to accomplish a common goal
- PO10. communicate effectively on engineering activities with the engineering society for the design and preparation of documentation and reports
- PO11. acquire knowledge of contemporary issues and recognize the need for lifelong learning
- PO12. apply knowledge of engineering and management principles in multidisciplinary environment and projects
- PSO1. design and develop models for signal processing and communication systems
- PSO2. design, develop and test electronic and embedded systems for real time applications

**COIMBATORE INSTITUTE OF TECHNOLOGY**  
(Government Aided Autonomous Institution Affiliated to Anna University, Chennai)

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

Curriculum from the Academic Year 2019 - 2020 and onwards

**COURSE OUTCOMES**

**SEMESTER III**

COURSE CODE & NAME	COURSE OUTCOME
19ECM31/ MATRICES, LINEAR ALGEBRA AND NUMERICAL METHODS	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Solve matrix problems in finding Eigen values and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.</p> <p>CO2. introduce the basic notions of groups, rings, fields which will then be used to solve related problems.</p> <p>CO3. understand the concepts of vector space, linear transformations and diagonalization.</p> <p>CO4. apply the concept of inner product spaces in orthogonalization.</p> <p>CO5. demonstrate accurate and efficient use of Numerical methods concepts to solve Engineering problems</p>
19EC31/ DIGITAL ELECTRONICS	<p>CO1. Determine the simplified digital logic circuits using the Boolean Algebra, Karnaugh Map and QuineMcCluskey methods and implementing with universal Gates</p> <p>CO2. Design a combinational logic circuit using adders/subtractors, encoders/decoders, multiplexer/demultiplexers and programmable logic circuits for arithmetic and logical operations.</p> <p>CO3. Design synchronous sequential logic circuits using different flip-flops for counters and shift registers.</p> <p>CO4. Design asynchronous sequential logic circuits with Race and Hazard free circuits.</p> <p>CO5. Construct programs for combinational and sequential logic circuit using VHDL code</p>
19EC32/ ANALOG ELECTRONICS	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Examine semiconductor diode characteristics and design rectifiers, voltage regulator and wave shaping circuits.</p> <p>CO2. Design DC biasing circuits for transistors and calculate their stability factors</p> <p>CO3. Design and analyze BJT amplifiers</p> <p>CO4. Design and analyze FET amplifiers</p> <p>CO5. i) Construct the different classes of power amplifiers and calculate their efficiencies ii) Design and analyze BJT and FET feedback amplifiers</p>
19EC33/ SIGNALS AND SYSTEMS	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Express continuous time &amp; discrete time signals using standard functions, represent continuous and discrete time systems and compute the response of LTI systems using linear convolution</p> <p>CO2. Use Fourier Transform to analyze and sketch the spectrum of continuous time signals and determine the frequency response of Linear Time Invariant continuous time systems</p> <p>CO3. Use Fourier Transform to analyze and sketch the spectrum of discrete time signals and determine the frequency response of Linear Time Invariant discrete time systems</p> <p>CO4. Illustrate the sampling of low pass signals in time domain and Fourier Transform approach</p> <p>CO5. Solve differential and difference equations and determine the response of Linear Time Invariant systems using Laplace &amp; z transform</p>
19EC34/ COMPUTER ARCHITECTURE AND ORGANIZATION	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1: Describe the concepts of computer architecture, Instruction set design and addressing mode.</p> <p>CO2: Illustrate the concepts of CPU design with fixed point and floating point arithmetic.</p> <p>CO3: Interpret the concepts of control design using hardwired and micro programmed control unit.</p>

	CO4: Exemplify the functions of memory subsystems to integrate with CPU. CO5: Illustrate the methodologies for interfacing I/O devices and explain the concepts of parallelism and concurrency in computers
19ECL35/ DIGITAL ELECTRONICS LABORATORY	Upon the completion of the course, students will be able to demonstrate an ability to CO1: Design, Construct and Simulate combinational logic circuit using Digital ICs CO2: Design, Construct and Simulate Sequential logic circuit using Digital ICs CO3: Develop communication skills and capability to work in team
19ECL36/ ANALOG ELECTRONICS LABORATORY	Upon completion of this course the students will be able to demonstrate an ability to  CO1. Construct and test diode based wave shaping and rectifier circuits CO2. i) Design and test different types of biasing circuits for given specifications and calculate their stability factors ii) Design, test and analyze the frequency response of BJT and FET amplifiers with and without feedback iii) Design and test power amplifiers CO3. Develop communication skills and capability to work in teams

#### SEMESTER IV

COURSE CODE/ NAME	COURSE OUTCOME
19EC41/ PROBABILITY AND STOCHASTIC PROCESS	Upon completion of this course the students will be able to demonstrate ability to CO1. Understand the basic concepts of probability and discrete random variables CO2. Understand the concepts of continuous and pairs of random variables and its usage in communication systems CO3. Understand the moment generating function for families of random variables CO4. Interpret the usage of stochastic process in communication systems CO5. Analyze the response of random inputs to linear time invariant systems and to understand the concept of power spectral density of a random sequence
19EC42/ PRINCIPLES OF COMMUNICATION	Upon completion of this course the students will be able to demonstrate ability to CO1 Illustrate DSB-FC, DSB-SC, SSB-SC, VSB amplitude modulation techniques & their spectrum, explain the function of DSB-SC and SSB-SC modulators and compare their performances CO2 Illustrate angle modulation techniques & their spectrum, compare their performances, and explain the operating principle of FM transmitter CO3 Describe the operation of AM & FM receivers, compare & distinguish between their performance characteristics and parameters CO4 Describe the operation of pulse analog modulation & pulse digital modulation techniques CO5 Express narrow band noise using I & Q components & estimate the performance of DSB-SC, SSB & FM Receivers systems using Figure of Merit and to compute the SNR of PCM and DM systems
19EC43/ MICROCONTROLLER BASED SYSTEMS	Upon completion of this course the students will be able to demonstrate an ability to CO1. Interpret the architecture & instruction Set of 8051 microcontroller to develop Assembly language programs. CO2. Illustrate the application of 8051 microcontroller on chip peripherals to implement the functions of I/O port, timer/Counter, serial port & interrupts. CO3. Exemplify the peripheral devices 8255 PPI and LCD display and traffic light controller, 8279 for interfacing keyboard and 7 segment display and 8259 PIC for handling multiple interrupts I/O. CO4. Integrate memory modules and the I/O devices ADC, DAC, Sensor & RTC with 8051 microcontroller for an application and develop Assembly Language Programs. CO5. Interpret the programming aspects of Arduino IDE to develop an Arduino based applications.
19EC44/ LINEAR	Upon completion of this course the students will be able to demonstrate ability to CO1. Interpret and analyze differential amplifiers with constant current sources,

INTEGRATED CIRCUITS	<p>Interpret the characteristics of operational amplifier</p> <p>CO2. design and analyze operational amplifier application circuits</p> <p>CO3. design and analyze filters &amp; oscillator circuits using operational amplifier</p> <p>CO4. analyze and design multivibrators and data converters using linear ICs</p> <p>CO5. apply the concepts of PLL to design frequency multiplier/divider, FSK demodulator and design voltage regulators using ICs</p>
19EC45/ ELECTROMAGNETIC FIELDS AND WAVEGUIDES	<p>Upon completion of this course the students will be able to demonstrate ability to</p> <p>CO1. Describe the concepts of Electrostatic fields with the help of mathematics and apply them for practical applications</p> <p>CO2. Describe the concepts of static Magnetic fields with the help of mathematics and apply them for practical engineering problems such as magnetic levitation</p> <p>CO3. Interpret Maxwell's equations for time varying Electromagnetic fields, determine its parameters for different media, distinguish various polarizations of plane waves and evaluate reflection and transmission coefficients</p> <p>CO4. Formulate general solutions for TE, TM &amp; TEM modes of parallel plate and Rectangular waveguides and determine parameters such as frequency, phase constant, velocity, attenuation and associated characteristic impedance for the waveguides.</p> <p>CO5. Formulate general solutions for TE, TM &amp; TEM modes of Circular waveguide and determine parameters such as frequency, phase constant, velocity, attenuation and associated characteristic impedance for the waveguide and Q factor of Rectangular Cavity Resonators</p>
19ECL46/ MICROCONTROLLERS LABORATORY	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Develop an 8051 microcontroller Assembly Language Programs using Assembler, KEIL IDE &amp; Proteus Simulator and interface ADC &amp; DAC boards with microcontrollers.</p> <p>CO2. Demonstrate real time applications using ARDUINO boards</p> <p>CO3. Develop communication skills and capability to work in team</p>
19ECL47/ LINEAR INTEGRATED CIRCUITS LABORATORY	<p>Upon completion of the course, the students will be able to demonstrate an ability to,</p> <p>CO1: Test and analyze the characteristics of operational amplifier and special purpose integrated circuits</p> <p>CO2: Design, simulate and test active filters, oscillators, multivibrators, comparators, Schmitt Trigger, data converters, PLL based frequency multiplier and voltage regulators</p> <p>CO3: Develop communication skills and capability to work in team</p>

**SEMESTER V**

COURSE CODE&NAME	COURSE OUTCOME
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<p>19EC51-CONTROL SYSTEMS</p>	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Ascertain the transfer function of Mechanical and Electrical systems using block diagram reduction and signal flow graph methods</p> <p>CO2. Determine time domain response, specifications, and steady state errors of first and second order systems and explain the importance of P, PI &amp; PID controllers in control systems design.</p> <p>CO3. Sketch and estimate frequency domain specifications of all-pass &amp; minimum phase systems using bode &amp; polar plots.</p> <p>CO4. Test the stability of system by applying Root locus, Nyquist stability criterion and Routh Hurwitz criterion for a system transfer function.</p> <p>CO5. Draw state model of electrical systems, determine the solution of state equation using state space representation and test the controllability and observability of systems using Kalman's test.</p>
<p>19EC52-DIGITAL SIGNAL PROCESSING</p>	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1: Compute the Discrete Fourier Transform (DFT) of a given discrete time sequence using Radix-2 Fast Fourier Transform algorithms and to compute the linear convolution of discrete time sequences using DFT.</p> <p>CO2: Design IIR Butterworth and Chebyshev type I low pass and high pass digital filters for given specifications and realize IIR systems using direct, cascade and parallel form structures.</p> <p>CO3: Design Linear phase low pass and high pass FIR digital filters using windowing &amp; frequency sampling methods and realize FIR systems using linear phase structures.</p> <p>CO4: Examine the effects of quantization error in digital filters.</p> <p>CO5: Explain the Applications of Digital Signal Processing</p>
<p>19EC53-EMBEDDED SYSTEMS AND IoT</p>	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Interpret the hardware/software components of an embedded system for an application and infer the architecture &amp; programming model of ARM processor.</p> <p>CO2. Infer the instruction set and exception types of ARM processor to develop Assembly language programs.</p> <p>CO3. Understand the serial and parallel communication devices and protocols and develop application software for embedded systems.</p> <p>CO4. Exemplify the key concepts in real time embedded application development using Real Time Operating System (RTOS).</p> <p>CO5. Interpret the characteristics, functional blocks and architecture of IoT to develop an IoT based applications</p>
<p>19EC54-ANTENNAS AND WAVE PROPAGATION</p>	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Understand the antenna fundamentals and parameters.</p> <p>CO2. Analyze the radiation characteristics of antenna array.</p> <p>CO3. Understand the radiation characteristics of special antennas.</p> <p>CO4. Illustrate antenna parameter measurement methods and Understand the characteristics of radio wave propagation.</p> <p>CO5. Interpret the physical significance of transmission line and impart knowledge in impedance transformation and matching using Smith Chart</p>

19ECL55-SIGNAL PROCESSING LABORATORY	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1: Analyze the Spectrum of Discrete time signals and frequency response of Linear TimeInvariant systems.</p> <p>CO2: Implement and test FIR/IIR Low pass &amp; High pass filters and analyze the quantization effects.</p> <p>CO3: Design and test the applications of Digital Signal Processing.</p>
19ECL56-EMBEDDED SYSTEMS AND IoT LABORATORY	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Develop an ARM Assembly Language Programs for Arithmetic &amp; array operations, timer/counter operation and interrupts and interfacing hardware with ADC, Temperature sensor, I2C based Serial EEPROM.</p> <p>CO2. Demonstrate applications of IoT using NODE MCU ESP 8266/ ARDUINO boards</p> <p>CO3. Develop communication skills and capability to work in team</p>

### SEMESTER VI

COURSE CODE& NAME	COURSE OUTCOME
19EC61/ VLSI DESIGN	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Examine the I-V and DC characteristics of MOS transistors and sketch the layout of CMOS Circuits</p> <p>CO2. Design and compare the static and dynamic CMOS combinational circuits using different logic styles</p> <p>CO3. Design the static and dynamic CMOS sequential circuits using different logic styles</p> <p>CO4. Develop and design VLSI sub systems and memories</p> <p>CO5. Explain FPGA architectures and VLSI Testing methods</p>
19EC62/ DIGITAL COMMUNICATION	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1: Calculate channel capacity based on entropy and mutual information using Shannon's Channel capacity theorem</p> <p>CO2: Comprehend various error control encoding and decoding techniques</p> <p>CO3: Discuss Inter Symbol Interference problem in baseband data transmission and derive the Nyquist criteria for distortion less transmission</p> <p>CO4: Describe and analyze different Digital modulation techniques on the basis of their spectral occupancy</p> <p>CO5: Discuss the design of optimal receiver for minimizing probability of error and analyze its performance</p>

19EC63/ DATA COMMUNICATION NETWORKS	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1 : Develop and Illustrate frame transmission for a given scenario. Estimate utilization percentage of data links in networks. Outline the concepts of computer networks, its layered architecture, and switching mechanisms.</p> <p>CO2 : Evaluate throughput at MAC layer level. Analyze adaptability of given data for a given LAN standard. Categorize given address into one of standard addressing techniques and schemes.</p> <p>CO3 : Design subnet masks, sub-blocks addressing scheme and identify routing mechanisms to fulfill networking requirements.</p> <p>CO4 : Analyze given Transport layer header and extract its field data. Describe the essential principles of transport layer protocols. Identify the key factors to improve the performance and QoS parameters of data communication networks.</p> <p>CO5 : Describe the features and operations of various application layer protocols like</p>
19ECL64/ VLSI DESIGN LABORATORY	<p>Upon the completion of the course, students will be able to demonstrate an ability to</p> <p>CO1. Design and simulate CMOS logic combinational &amp; sequential circuits using backend tool</p> <p>CO2. Examine the power and stuck at faults in combinational circuits</p> <p>CO3. Work in teams to achieve goals and communicate effectively</p>
19ECL65/ ANALOG AND DIGITAL COMMUNICATION LABORATORY	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Construct and test analog modulation, pulse amplitude modulation, pulse code modulation, digital modulation and demodulation circuits</p> <p>CO2. Simulate and test Linear Block Coders, Cyclic Coders and Convolutional Coders</p> <p>CO3. Develop communication skills and capability to work in team</p>

## SEMESTER VII

COURSE CODE & NAME	COURSE OUTCOME
19EC71/ DIGITAL IMAGE PROCESSING	<p>Upon completion of this course, students will be able to demonstrate an ability to</p> <p>C01. Describe the digital image formation process &amp; its representation and compute forward and inverse transform for an image.</p> <p>C02. Apply image enhancement techniques in spatial and frequency domain for improving the visual perception of an image.</p> <p>C03. Describe noise models and apply restoration filters &amp; morphological operators to an image.</p> <p>C04. Interpret image quality and describe image compression techniques.</p> <p>C05. Make use of image segmentation techniques to extract regions of interest from an image and construct descriptors to describe region in a form suitable for computer processing</p>
19EC72/ MICROWAVE ENGINEERING AND OPTICAL COMMUNICATION	<p>Upon completion of this Course the students will be able to demonstrate an ability to</p> <p>CO1. Analyze and characterize given system or networks based on their scattering parameters.</p> <p>CO2. Analyze the generation of Microwave signals and understand its construction</p> <p>CO3. Explain the operating principle of microwave semiconductor devices and measuring losses, VSWR, scattering and spectral parameters.</p> <p>CO4. Explain the concepts of optical fibers communication systems and various signal degradation factors associated with optical fibers</p> <p>CO5. Explain the various optical fiber measurements based on the transmission, optical and mechanical characteristics</p>

19EC73/ WIRELESS COMMUNICATION AND NETWORKS	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Illustrate path loss, small scale and large scale fading in mobile channels</p> <p>CO2. Describe the cellular concepts, Channel Assignment Strategies, Multiple access techniques and interpret the cellular capacity</p> <p>CO3. Explain about the concept of different Digital Signaling for fading channels</p> <p>CO4. Compare different linear equalization algorithms &amp; diversity techniques and conclude their choice for wireless channels</p> <p>CO5. Explain wireless network architecture with their standards</p>
19EC74/WIRELESS COMMUNICATION AND NETWORKING LABORATORY	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Implement the fading channel models, diversity &amp; equalization techniques and multi carrier modulation techniques</p> <p>CO2. Simulate and test the performance of wireless communication systems and networks</p> <p>CO3. Develop communication skills and capability to work in team</p>
19ECL75/ HIGH FREQUENCY LABORATORY	<p>Upon completion of this Course, the students will acquire practical knowledge to:</p> <p>CO1. Test and measure parameters, interpret and analyze measured data, record and present results of tests on passive microwave devices.</p> <p>CO2. (i) Test and measure parameters, interpret and analyze measured data, record and present results of tests on passive antennae, fiber-optic cable and optic devices. (ii) Design, Simulate, observe results, interpret and analyze measured data, record and present results of simulations of antenna and micro-striplines.</p> <p>CO3. Develop Communication Skills and capability to work in team and achieve goals</p>

### PROFESSIONAL ELECTIVES

#### COMMUNICATION & SIGNAL PROCESSING

COURSE CODE/NAME	COURSE OUTCOME
19ECE01/ MULTIMEDIA COMPRESSION AND COMMUNICATION	<p>Upon completion of this course the students will be able to demonstrate ability to</p> <p>CO1: Illustrate various multimedia components and its characteristics.</p> <p>CO2: Determine the average length of text and image by various compression techniques, and calculate the compression ratio.</p> <p>CO3: Interpret the various techniques for audio and video compression.</p> <p>CO4: Illustrate the network architecture and various communication protocols for VoIP. Identify the challenges and key factors to improve the performance and QoS parameters of VoIP.</p> <p>CO5: Analyze the various multimedia networking protocols to provide the best effort service for Real time interactive multimedia application.</p>
19ECE02/ DIGITAL SWITCHING AND TRANSMISSION	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1: Understand the fundamental building blocks of digital switching and their operating principles including signaling.</p> <p>CO2: Explain the features and operation of time space switching mechanisms.</p> <p>CO3: Analyze and determine traffic parameters related to call connect and grade of service.</p> <p>CO4: Describe the concepts and explain the operating principles of network synchronization and clock recovery.</p> <p>CO5: Describe the structure of PDH SDH and Cross connect networks and their operation</p>
19ECE03/	Upon completion of this course, the students will be able to demonstrate ability to

INTRODUCTION TO MACHINE LEARNING	<p>CO1. understand and illustrate a wide variety of examples in supervised and unsupervised learning algorithms.</p> <p>CO2. <i>a.</i>analyze uncertain probabilities and make rational decisions to minimize risk with associate rules from data. <i>b.</i>understand the parametric approach for classification and regression models.</p> <p>CO3. design a function that learns from a labeled multivariate sample by fine tuning the complexity of the data.</p> <p>CO4. explain various feature selection methods to extract subset of important features from original inputs.</p> <p>CO5. <i>a.</i>apply clustering methods to learn the mixture of parameters from data to various class. <i>b.</i>understand learning algorithms that build decision tree for labeled training samples in classification and regression models</p>
19ECE04/ SIGNAL PROCESSING USING PYTHON	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1 : Explain the principles of Numerical Python Basics</p> <p>CO2 : Apply Numpy to perform filtering and Convolution</p> <p>CO3 : Perform spectral analysis in Python</p> <p>CO4 : Design and develop FIR digital filters using window methods in Python</p> <p>CO5 : Design and develop IIR Butterworth and Chebyshev digital filters in Python</p>
19ECE05/ ADVANCED DIGITAL SIGNAL PROCESSING	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Illustrate the characteristics of random processes</p> <p>CO2. Estimate the frequency spectrum of random signal by using various power spectrum estimation techniques</p> <p>CO3. Design a Wiener filter to produce minimum mean square estimate for linear prediction and Develop an adaptive filter algorithms for real time signal processing application</p> <p>CO4. Analyze the spectral characteristics of sample rate converted discrete time signals by using interpolation and decimation</p> <p>CO5. Design filter bank with different structure for computation complexity reduction</p>
19ECE06/ SPEECH SIGNAL PROCESSING	<p>Upon completion of this course the students will be able to demonstrate ability to</p> <p>CO1. Describe the concepts of speech production</p> <p>CO2. Analyze the time domain parameters for speech processing</p> <p>CO3. Analyze the frequency domain methods for speech processing</p> <p>CO4. Illustrate the Linear Predictive analysis with its parameters for speech processing</p> <p>CO5. Infer the concepts of speech processing for real time applications</p>
19ECE07/ WEARABLE SYSTEMS	<p>Upon completion of this course, the students will be able to demonstrate an ability to</p> <p>CO1. Categorize and explain the type of sensors used in wearable systems.</p> <p>CO2. Analyze the wearability issues in signal processing.</p> <p>CO3. Specify the types of energy harvesting methods for wearable devices.</p> <p>CO4. Explain the techniques used in wireless health systems.</p> <p>CO5. List out and explain the applications of wearable systems</p>
19ECE08/ ADAPTIVE SIGNAL PROCESSING	<p>Upon completion of this course the students will be able to demonstrate ability to</p> <p>CO1: Illustrate the characteristics, applications and properties of Adaptive Systems.</p> <p>CO2: Explain theory of adaptation with stationary signals.</p> <p>CO3: Examine the concepts of gradient and mean square error performance in adaptive systems.</p> <p>CO4: Exemplify LMS algorithms and constraints associated with it.</p> <p>CO5: Describe the various applications of adaptive signal processing.</p>
19ECE09/ INFORMATION THEORY AND CODING	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1: Evaluate the information content in a discrete memoryless source through parameters such as entropy and mutual information.</p> <p>CO2: Estimate a channel's capacity based on Shannon's channel capacity theorem</p>

	<p>CO3: Construct efficient source coding schemes based on the entropy of source and probability of input variables</p> <p>CO4: Develop channel error control codes using BCH and RS algorithms</p> <p>CO5: Design of various coding techniques for AWGN and fading channels</p>
19ECE10/ COMMUNICATION SYSTEM DESIGN	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1: Discuss the characteristics and properties of LTIV systems</p> <p>CO2: Analyze the spectral characteristics of discrete time signals by using filters and analyze the sample rate converted discrete time signals by interpolation and decimation</p> <p>CO3: Outline different bandpass modulation &amp; demodulation techniques and compare their performance</p> <p>CO4: Apply channel coding procedure and calculate coding efficiency</p> <p>CO5: Analyze the performance of Spread Spectrum and OFDM system</p>
19ECE11/ OVERVIEW OF INDUSTRY 4.0	<p>Upon completion of this course the students will be able to demonstrate ability to</p> <p>CO1: Illustrate design principle scenarios, principles and strategies of automation and the basic elements of automated system and explain transfer mechanisms and cyber physical systems</p> <p>CO2: Illustrate data acquisition systems objectives and Nyquist sampling theorem classification and types of filters and design of filters with their application</p> <p>CO3: Compare and distinguish the industrial advantages of Nano electrical and electronic devices and the significance of Nanotech in industrial application.</p> <p>CO4: Describe the machine to machine communication and their application over agriculture, health care and activity monitoring.</p> <p>CO5: Express Robot Classification, Robotic System Components, Different Orientation Descriptions and Robot control architecture</p>
19ECE12/ CRYPTOGRAPHY AND NETWORK SECURITY	<p>Upon completion of this course, the students will be able to demonstrate an ability to</p> <p>CO1. Describe the issues, scope and significance of various security mechanisms and services applicable to Communication networks. Explain and analyze, algorithms and techniques of Block and Stream ciphers.</p> <p>CO2. Describe the concepts and applications of Modern Symmetric Key Ciphers</p> <p>CO3. Describe the concepts and applications of Asymmetric Key Encipherment</p> <p>CO4. Explain about concepts and applications of Integrity Authentication and Key management</p> <p>CO5. Discuss the concepts of security at application, transport and network layer</p>
19ECE13/ PARALLEL AND DISTRIBUTED PROCESSING	<p>Upon completion of this course, the students will be able to demonstrate an ability to</p> <p>CO1. Describe the architecture of models of parallel computers</p> <p>CO2. Illustrate the key concepts of advanced processor and memory hierarchy technology</p> <p>CO3. Exemplify the types of pipelining methods for super scalar architecture</p> <p>CO4. Interpret the models, languages and compilers for parallel programming</p> <p>CO5. Infer the concepts of distributed systems</p>
19ECE14/ OPTICAL COMMUNICATION NETWORKS	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1: Explain the working of an Optical component based on its scattering parameters</p> <p>CO2: Explain the architecture and traffic flow of different client layer Optical networks.</p> <p>CO3: Analyze traffic models applicable for wavelength routing networks and determine the cost trade-off for designing a ring network</p> <p>CO4: Illustrate the function of the Photonic packet switching network and explain different architecture of access networks</p> <p>CO5: Identify, illustrate and compare the management and control aspects of optical networks</p>
19ECE15/ SOFT COMPUTING AND APPLICATIONS	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Interpret the basic concepts of artificial neural networks and fuzzy logic</p> <p>CO2. Analyze the various neural network algorithms for real time optimization problems</p> <p>CO3. Infer the concepts and methods of fuzzy systems</p> <p>CO4. Apply the Genetic algorithm for single objective and multiobjective optimization problems</p> <p>CO5. Interpret the techniques of hybrid computing algorithms and to develop an</p>

	applications
19ECE16/ COGNITIVE RADIO COMMUNICATION SYSTEMS	Upon completion of this course the students will be able to demonstrate an ability to CO1:describe the evolution of software defined radio and cognitive radio CO2:illustrate the architecture of cognitive radio communication system CO3:analyze and explain different spectrum sensing techniques and dynamic spectrum access CO4:explain the MAC and Network layer design for Cognitive Radio CO5:illustrate the applications of Cognitive Radio
19ECE17/ NEXT GENERATION NETWORKS	Upon completion of this course the students will be able to demonstrate an ability to CO1: Explain the concepts of SDN network and integration with LTE. CO2:Discuss the concepts of Traffic Transport and Network Management in SDMN CO3:Explain the principles of Resource and Mobility Management in SDMN CO4:Discuss the concepts of NGN architecture and service evolution CO5:Explain the features of NGN management and standardization
19ECE18/ WIRELESS ADHOC AND SENSOR NETWORKS	Upon completion of this course the students will be able to demonstrate an ability to  CO1. Outline the challenges & issues in the wireless Ad Hoc and sensor network and its subsystems and Interpret network architecture and its components CO2. Describe the essential principles of the MAC protocols for Wireless Ad Hoc Networks CO3. Explain the Routing & Transport protocols for Wireless Ad Hoc Networks CO4. Discuss the features of MAC & Routing protocols for WSN CO5. Explain the principles of localization tracking and infrastructure establishment in WSN
19ECE19/ WIRELESS NETWORKS AND STANDARDS	Upon completion of this course the students will be able to demonstrate an ability to  CO1. (i) Outline the concepts of TDMA , GSM, CDMA in the Second generation wireless cellular networks (ii) Describe and compare the air interface techniques in the second generation systems. (iii) Summarize the UMTS Services, air interface techniques, WCDMA and CDMA in the third generation systems CO2. Describe the working principles of various wireless standards and its operations CO3. Describe the Function of Mobile IP and Outline the various wireless application protocols CO4. Outline the various types wireless LANs and Summarize the Wireless LAN Standards CO5. Describe the features and operations of various Wireless Personal Area Networks and its standards
19ECE20/ 5G NETWORKS	Upon completion of this course the students will be able to demonstrate an ability to CO1. Describe about the fundamental concepts of 4G & 5G networks CO2. Explain about 5G Modulation Schemes CO3. Explain about Multiple Access techniques in 5G networks CO4. Analyze the behavior of different optimization for power control CO5. Explain about Massive MIMO for 5G networks
19ECE21/ NETWORK ROUTING AND INFRASTRUCTURE MANAGEMENT	Upon completion of this course the students will be able to demonstrate an ability to CO1:Understand fundamental networking concepts CO2:Interpret concepts of switching, cable categories and connection tools. CO3:Understand IP addressing- IPV4 and IPV6 2 Understand Domain and work group users CO4:Analyze WAN technologies and connectivity options CO5:Understand configuration of domain names, security issues and infrastructure management
19ECE22/ RADAR AND NAVIGATIONAL AIDS	Upon completion of this course the students will be able to demonstrate an ability to CO1:Define radar parameters and effects of various factors on radar CO2: Compare MTI, Pulsed Doppler and CW radar systems and describe the principles of operation of delay line cancellers, filters and signal processing techniques and

	<p>comprehend the effect of these on radar systems' performance.</p> <p>CO3: Explain the principles and operation of Sequential lobbing , Conical Scanning and Mono-pulse tracking radars</p> <p>CO4: Outline the principles and operation of radio navigation systems and landing systems</p> <p>CO5: Explain the principles and operation of various satellite based navigation systems and analyze various navigations satellites</p>
19ECE23/ SATELLITE COMMUNICATION	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1: outline the elements and types of satellite orbits, determine the orbital parameters</p> <p>CO2: describe the subsystems of satellite communication systems and earth station systems</p> <p>CO3: apply the link design for signal to noise ratio calculations</p> <p>CO4: explain different multiplexing techniques for satellite systems</p> <p>CO5: describe the use of satellite systems for various applications</p>

## **EMBEDDED SYSTEMS**

<b>COURSE CODE &amp; NAME</b>	<b>COURSE OUTCOME</b>
19ECE24/ DATA STRUCTURES AND ALGORITHMS	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1: Describe algorithm, its notations and its complexity</p> <p>CO2: Analyze the algorithms with the knowledge of basic data structures such as arrays, stacks and queues with implementations</p> <p>CO3: Use the concept of linked lists with different possible operations and applications and apply the concept of trees in data structures</p> <p>CO4: Apply the suitable graph algorithm for given applications</p> <p>CO5: Analyze sorting and searching algorithms for given applications</p>
19ECE25 OPERATING SYSTEMS	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1 : Outline the basic functionalities of operating systems, operating system components, various types of operating system and system software, and features of Macro-processors, linkers and loaders.</p> <p>CO2 : Demonstrate process control and apply scheduling algorithms.</p> <p>CO3 : Apply principles of mutual exclusion and synchronization techniques to demonstrate process execution.</p> <p>CO4 : Examine various memory management schemes and find suitable technique to design a system.</p> <p>CO5 : Describe disk scheduling algorithms, Secondary storage management techniques, file organization and access methods.</p>
19ECE26 REAL TIME APPLICATIONS USING PYTHON	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1: Infer the programming concepts of Python to develop simple computational programs.</p> <p>CO2 : Implement Python programs with conditionals &amp; loops and functions.</p> <p>CO3: Use Python lists, tuples &amp; dictionaries for representing compound data and input/output with files.</p> <p>CO4: Implement Python programs using OOPs concepts.</p> <p>CO5 : Develop real time applications of Raspberry Pi3 using LEDs , Sensors, LCD Display , motor control and web server.</p>
19ECE27 DESIGN FUNDAMENTALS OF ELECTRIC AND HYBRID VEHICLES	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1: Students will acquire the knowledge about electric vehicle components, efficiency and vehicle dynamics.</p> <p>CO2: Illustrate about electric and hybrid vehicle architecture and power train components.</p> <p>CO3: Describe the concepts of battery fundamentals and fuel cell, super capacitor energy storage.</p> <p>CO4: Design the different types of power electronics converters and electrical machines.</p> <p>CO5: Describe the concepts of hybrid vehicle control strategy</p>
19ECE28 AUTOMOTIVE ELECTRONICS	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1: Design modules for hybrid vehicle using automotive system components.</p> <p>CO2: Modify the automobile Electronic Engine Control to improve fuel economy, safety and</p>

	<p>comfort in Automobiles as per the government test procedures.</p> <p>CO3:Design control system in automotive by appropriate choice of Sensors and actuators.</p> <p>CO4: Determine the vehicle parameters to control engine functioning and interpret vehicle's self-diagnostic codes.</p> <p>CO5:Examine internal communication network that interconnects the components inside a vehicle to reduce the fatal accidents and delays</p>
19ECE29 ADVANCED PROCESSOR ARCHITECTURE S	<p>Upon completion of this course, the students will be able to demonstrate an ability to</p> <p>CO1:Exemplify the architecture, trends and applications of parallel processing and memory systems</p> <p>CO2: Elaborate the principles and classification of pipelining concepts.</p> <p>CO3: Develop clear idea about the networking concepts and algorithms for array processors.</p> <p>CO4: Illustrate the architectural principles &amp; programming of multiprocessor and concepts on system deadlocks.</p> <p>CO5: Describe architecture, features and applications of MSP430 Microcontroller and TMS320C6713 DSP processor</p>
19ECE30 IoT BASED SYSTEM DESIGN	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1: Interpret architecture for IoT and system management based of IoT.</p> <p>CO2: Examine the communication technologies and protocols of IoT.</p> <p>CO3: Familiarize with the physical devices and logical design of IoT.</p> <p>CO4: Design simple IoT systems comprising sensors, edge devices, wireless network connections, data analytics capabilities and cloud storage.</p> <p>CO5.Describe IoT based applications for Home, Industry Automation, agriculture and productivity applications</p>
19ECE31 REAL TIME OPERATING SYSTEMS	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1 :Determine the concepts of Real time operatingsystems.</p> <p>CO2 :Illustrate the concepts of scheduling and implement the algorithm to develop Real time oper systems</p> <p>CO3: Explain and summarize the concepts of multiprocessor system.</p> <p>CO4 : Determine the concepts of distributedin Real time systems</p> <p>CO5 : Exemplify the performance and benchmarking of RTOS</p>
19ECE32 ROBOTICS	<p>Upon completion of this course, the students will be able to demonstrate an ability to</p> <p>CO1 : Describe the concepts of robotics, safety measures and homogeneous transformation.</p> <p>CO2 : Formulate the concepts of mechanical drives and sensors in robotics.</p> <p>CO3 : Exemplify the concepts of artificial intelligence and problem solving by searching.</p> <p>CO4 : Develop robotics programming, classifications and its applications.</p> <p>CO5 : Illustrate the methodologies in robot task planning and problem solving techniques</p>
19ECE33 REAL TIME CONTROLLERS	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1:Interpret the concepts and compare the characteristics of real - time systems to choose the architecture of a Real time Controller for an application.</p> <p>CO2:Infer the architecture and Instruction set of C2000 Processor to develop Assembly language programs</p> <p>CO3:Appraise the data format, Addressing modes, Pipelining and Interrupt handler of C2000 processor for real time constraints</p> <p>CO4:Determine the concepts of Energy estimation techniques in Real time Systems</p> <p>CO5:Examine the communication protocols for real time applications</p>
19ECE34 REAL TIME MICROCOMPUT ER SYSTEMS	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1 : Illustrate the concepts of Real time systems and choose scheduling algorithms to develop Realtime systems</p> <p>CO2 : Interpret the programming languages and tools to develop application software for Real timesystems</p> <p>CO3 : Determine the concepts of database techniques in Real time systems</p> <p>CO4 : Examine the fault tolerance techniques for Real time applications</p> <p>CO5 : Exemplify the evaluation techniques for fault tolerance in Real time systems</p>

## ELECTRONICS & VLSI

<b>COURSE CODE &amp; NAME</b>	<b>COURSE OUTCOME</b>
19ECE35 BIOMEDICAL INSTRUMENTATION	Upon completion of this course, the students will be able to demonstrate ability to CO1. explain the Physiological signals and transducers used in biomedical engineering. CO2. infer the physiological parameters using specific types of meters and analyzers. CO3. categorize the different types of electrode systems and find suitable application for the bio electric events. CO4. describe the equipment used in medical imaging. CO5. determine the type of life assisting devices , explain the different diagnostics and therapeutic techniques for medical applications.
19ECE36 POWER ELECTRONICS	Upon completion of this course the students will be able to demonstrate an ability to CO1 : Illustrate the static and dynamic characteristics of power semiconductor devices. CO2 : Analyze the performance of phase controlled rectifiers. CO3 : Explain the operation and switching techniques of DC-DC converters CO4 :Apply voltage control and harmonic elimination methods to inverters. CO5 : Explain the operation of AC voltage controllers and cycloconverters
19ECE37 SENSORS AND TRANSDUCERS	Upon completion of this course the students will be able to demonstrate an ability to CO1. Interpret the working principles and applications of strain and pressure sensors. CO2. Categorize the type of motion sensors used for different applications CO3. Exemplify the working of different types of light radiation sensors . CO4. Illustrate the key concepts of heat and temperature sensors used to measure the temperature parameters. CO5. Explain the construction and working of Electronic sensors
19ECE38 BIOMEDICAL TRANSDUCERS AND BIOSENSORS	Upon completion of this course the students will be able to demonstrate an ability to CO1 : explain the principles of resistive transducers , blood pressure transducers , Capacitive transducers , inductive transducers and their applications. CO2 : explain the principles of temperature transducers and Piezoelectric transducers and their applications. CO3 : explain the principles of different types of pressure transducers. CO4 : explain the principle of biopotential electrodes. CO5 : explain the principle of Biosensors and their applications
19ECE39 NANO ELECTRONICS	Upon completion of this course the students will be able to demonstrate an ability to CO1. Interpret the concepts of diverse Electron microscopes based on their construction techniques. CO2. Infer the formation and properties of nanotube and identify the appropriate structure of nanotubes for memory application. CO3. Infer the concepts of Quantum physics, Quantum electronic devices and apply them in Quantum computers. CO4. Illustrate the features of diverse Logic devices and reconstruct the single electron device for logic applications. CO5. Use nanobio sensors and develop sensor based medical devices
19ECE40	Upon completion of this course the students will be able to demonstrate an

<p>NANO SENSORS AND DEVICES</p>	<p>ability to  CO1: Illustrate the concepts of characteristics and the classification of nano sensor.  CO2: Infer the material properties and the classification of nanostructured materials.  CO3: Describe the different types of biosensors based on nanostructured materials.  CO4: Describe the different types of chemical based nano sensors.  CO5: Discuss about the microscopic techniques to view nanomaterials and future trends of nano sensors.</p>
<p>19ECE41  VERILOG HDL</p>	<p>Upon completion of this course the students will be able to demonstrate an ability to  CO1:Understand about the design methodologies in Verilog HDL  CO2: Design various combinational circuits using gate level modeling  CO3: Design combinational circuits using data flow level modeling  CO4: Understand about the design of combinational circuits using behavioral modeling  CO5: Verify and design the digital circuits using switch level modeling</p>
<p>19ECE42  HDL BASED SYSTEM DESIGN</p>	<p>Upon completion of this course the students will be able to demonstrate an ability to  CO1.design basic combinational and sequential circuits using VHDL  CO2.design and write VHDL code for carry look ahead adder, binary multiplier and dividers using state graphs  CO3.design and develop VHDL codes for digital circuits using State Machine charts  CO4.understand the representation of floating-point number, perform floating point addition and multiplication  CO5.design and write VHDL code for static RAM memory and a RISC microprocessor</p>
<p>19ECE43  INTRODUCTION TO MINIATURIZATION TECHNOLOGIES</p>	<p>Upon completion of this course the students will be able to demonstrate an ability to  CO1.Interpret the concepts of micro electro mechanical systems and the working principle of MEMS systems.  CO2: Infer the material properties and the fabrication process of microsystems.  CO3: Infer the properties and the classification of nanostructure devices.  CO4: Describe the different methods of synthesis and the characterization of nanomaterials.  CO5: Describe CAD tools and micro, nano based applications for medicine, agriculture and bio-technology and robotics</p>
<p>19ECE44  MEMS</p>	<p>Upon completion of this course the students will be able to demonstrate an ability to  CO1. Develop the MEMS and Microsystems using fabrication, sensing and actuation mechanisms.  CO2. Design the MEMS goods by using elasticity, stress ,strain and material properties.  CO3. Analyze the characteristics of electrostatic and electromagnetic for designing actuators and motors.  CO4. Examine the concepts of issues in MEMS circuits and systems and to model and devise the CAD for MEMS  CO5. Determine the design conceptions for RF and optical MEMS applications</p>
<p>19ECE45  VLSI PROCESS TECHNOLOGY</p>	<p>Upon completion of this course the students will be able to demonstrate an ability to  CO1: Understand the physics of Crystal growth, wafer fabrication and basic properties of silicon wafer.  CO2: Infer the concepts of various lithography and etching techniques.  CO3: Describe the different process of wafer exposure system.  CO4: Describe the process of IC fabrication technology.  CO5: Discuss about the analytical, assembly and packaging techniques of VLSI devices.</p>
<p>19ECE46</p>	<p>Upon completion of this course the students will be able to demonstrate an</p>

LOW POWER VLSI DESIGN	<p>ability to</p> <p>CO1: Explain the sources of power dissipation in CMOS</p> <p>CO2: Summarize the power optimization and trade-off techniques in digital circuits</p> <p>CO3: Learn how to design low power memories and special techniques</p> <p>CO4: Illustrate the power estimation at logic and circuit level</p> <p>CO5: Explain the software design for low power in various level</p>
19ECE47 IC FABRICATION TECHNOLOGY	<p>Upon completion of the course, students will be able to demonstrate an ability to</p> <p>CO1.Explain the basic IC fabrication, cleaning and etching process.</p> <p>CO2.Explain the different methods of epitaxy and oxidation</p> <p>CO3.Explain metal and non-metal deposition and plasma, RIE &amp; RTP etching techniques</p> <p>CO4.Analyze the different methods of lithography and diffusion</p> <p>CO5.Explain implantation equipment, annealing &amp; shallow junctions and NMOS, CMOS technologies</p>
19ECE48 CMOS ANALOG IC DESIGN	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1 : Realize the concepts of single stage amplifiers and design</p> <p>CO2 : Analyze the modes of operation of differential amplifiers and current mirrors</p> <p>CO3 : Understand the frequency response and noise characteristics of single stage amplifiers and differential amplifiers followed by loading effect in feedback networks</p> <p>CO4 : Explain single stage and two stage operational amplifiers and its compensation techniques</p> <p>CO5 : Discuss about the switched capacitor filters, oscillators and PLL</p>

### MICROWAVE& RF

COURSE CODE& NAME	COURSE OUTCOME
19ECE49/ ELECTROMAGNETIC RADIATION HAZARDS AND SAFETY	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1.Interpret the sources of extremely low frequency and radio frequency radiation.</p> <p>CO2.Explain the biological interaction of Electromagnetic Radiation on human cells and threat to Cancer.</p> <p>CO3: Analyze the Dosimetry effects of Electromagnetic Radiation using Specific AbsorptionRate.</p> <p>CO4: Describe the safety standards and International Regulations framed for radiationprotection.</p> <p>CO5: Infer the radio frequency survey on Mobile phones, Microwave ovens and Medical devices.</p>
19ECE50/ MODERN ANTENNAS	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1.Explain the concept and applications of PIFA, Helical &amp; Ceramic chip antennas and Illustrate SAR value measurement &amp; minimization methods for mobile handset.</p> <p>CO2.Categorize Fractal structuresand determine the radiation parameters of simpleFractal antenna.</p> <p>CO3.Categorize antennas for millimeter wave and sub-millimeter wave applications based on their operating frequency and Explain the concept andradiation parameters of Substrate integrated waveguide,Dielectric resonator,Reflector antennas.</p> <p>CO4.Explain the techniques for broad impedance bandwidth &amp; enhanced radiation performance and applications in high speed wireless communication</p> <p>CO5.Derive and describe narrowband beam processing techniques for smart antenna such as Conventional, Null steering &amp; Optimal beam former and Optimal beam space processor.</p>

19ECE51/ ADVANCED ANTENNA TECHNOLOGY	Upon completion of this course, the students will be able to demonstrate an ability to CO1.Comprehensive knowledge of various antennas design and performance parameters of antenna. CO2.Ability to understand design constraints of smart antennas for different application. CO3.Understand the basic concept of mobile satellite antennas in Satellite Communication. CO4.Describe the different design techniques for mobile-phone antennas and implementation of different techniques used for SAR reduction. CO5.Explain the concept and applications of Spiral antenna, flagpote& ILS antennas and different advance antennas presently in practice
19ECE52/ ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	Upon completion of this course the students will demonstrate ability to CO1.Explain EMI/EMC concepts and its sources CO2.Explain the various coupling principles and standards CO3.Describe the various EMI measurement methods and its control techniques CO4.Describe the performance of EMC design for PCBs. CO5.Explain the Measurement techniques for emission and about EMC standards
19ECE53/ RF MICROELECTRONICS	Upon completion of this course the students will be able to demonstrate an ability to CO1.Examine transceiver architecture and analyses RF components for effective transmission and Reception CO2.Analyze impedance matching issues in Low Noise Amplifiers, mixers and Gilbert Cells. CO3.Categorize and explain oscillators for RF Signal generation CO4.Describe Phase detectors, charge pumps and synthesizers and infer stability issues CO5.Assess the impedance matching issues in power amplifier during large signal power amplification

### OPEN ELECTIVE COURSES

COURSE CODE & NAME	COURSE OUTCOME
19ECEOE01/ SIGNAL PROCESSING AND ITS APPLICATIONS	Upon completion of this course the students will be able to demonstrate an ability to CO1.Compute the Discrete Fourier Transform (DFT) of a given discrete time sequence using Radix-2 Fast Fourier Transform algorithms and design FIR/IIR Filters CO2.Apply source coding procedure to calculate coding efficiency based on entropy & mutual information and outline different pulse analog modulation techniques CO3.Analyze various equalization techniques and compare its performance CO4.Calculate channel capacity using Shannon's channel capacity theorem and develop channel error control codes CO5.Analyze speech processing methods in time and frequency domain and design codec methods for speech compression techniques
19ECEOE02/ SMART SENSORS AND IOT	Upon completion of this course the students will be able to demonstrate an ability to CO1.Explain the classification ,types,packaging and testing of smart sensors CO2.Interpret the construction and working principles of Electronic sensors CO3.Exemplify the working of different types of light radiation sensors . CO4.Illustrate the key concepts of temperature ,gas and airquality sensors used to measure the parameters. CO5.Interpret the characteristics, functional blocks and architecture of IoT to develop an IoT based applications

<p>19ECEOE03/ CONSUMER ELECTRONICS</p>	<p>Upon completion of this course, students will be able to demonstrate an ability to</p> <p>CO1: Understand the various types of microphones and loudspeaker.  CO2: Explain the principle and working of Monochrome TV.  CO3: Describe the Colour TV scanning process and camera tube.  CO4: Illustrate LCD, LED TV, working of cable TV and DTH.  CO5: Interpret the significant technical considerations using a broad systems perspective.</p>
<p>19ECEOE04/ ROBOTICS</p>	<p>Upon completion of this course, students will be able to demonstrate an ability to</p> <p>CO1 : Describe the concepts of robotics, safety measures and homogeneous transformation.  CO2 : Formulate the concepts of mechanical drives and sensors in robotics.  CO3 : Describe the types of sensors and Robotic Vision  CO4 : Develop robotics programming, classifications and its applications.  CO5 : Exemplify the concepts of artificial intelligence.</p>
<p>19ECEOE05/ INFORMATION THEORY AND CODING TECHNIQUES</p>	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1..Explain the information content in a discrete memoryless source through parameters such as entropy and mutual information.  CO2. Estimate a channel's capacity based on Shannon's channel capacitytheorem  CO3. Analyze various channel encoding and decoding methods  CO4.Design and develop an error control coding methods for random error and burst error detection and correction techniques  CO5.Understand different applications in coding techniques</p>
<p>19ECEOE06/ WIRELESS SENSOR NETWORKS</p>	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Outline the challenges &amp; issues in the wireless sensor network and its subsystems and interpret network architecture and its components  CO2. Describe the essential principles of the MAC protocols for Wireless Sensor Networks  CO3. Elucidate the Routing &amp; localization tracking inWireless Sensor Networks  CO4. Discuss the features of WSN Operating systems  CO5. Illustrate the methodologies to provide WSN based solution for various critical issues</p>
<p>19ECEOE07/ AUTOMOTIVE EMBEDDED SYSTEMS</p>	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1. Design modules for hybrid vehicle using automotive system components.  CO2. Design control system in automotives by appropriate choice of Microcontrollers, Sensors and actuators.  CO3. Examine the communication protocols for real time applications  CO4. Understand the safety and comfort in Automobiles as per the government test procedures.  CO5. Understand the communication and diagnostic protocols</p>

<p>19ECEOE08/ 5G TECHNOLOGIES AND APPLICATIONS</p>	<p>Upon completion of this course, the students will be able to demonstrate ability to</p> <p>CO1.describe the evolution of cellular systems from 2G to 4G CO2.explain the motivation, targets of 5G technology and its standardization CO3.elaborate the 3GPP releases and 5G radio access network architecture CO4.discuss the services offered by 5G deployment and its design approaches CO5.understand the role between 5G and emerging next generation wireless technologies</p>
<p>19ECEOE09/ VEHICULAR COMMUNICATION</p>	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1.Understand basic principles, technologies, and system architecture of vehicular ad-hoc networks (VANET) CO2.Analyze Physical Layer and MAC Layer for signal propagation for vehicular communication CO3.Describe the various routing mechanisms and protocols to fulfill vehicular networking requirements. CO4.Explain the challenges and issues in establishing cellular V2X connection and mobility management. CO5.outline vehicular communication platforms for various emerging applications</p>
<p>19ECEOE10/ SENSING FOR AUTOMOTIVE SYSTEMS</p>	<p>Upon completion of this course the students will be able to demonstrate an ability to</p> <p>CO1.Acquaint with the basic automotive system components and need for automotive sensors. CO2. Discuss the fundamentals of various Power train sensors in automotive systems. CO3. Comprehend various sensors for chassis management. and the sensors for vehicle management &amp; security systems in Automobiles. CO5.Examine the vehicle communication protocols standards in automotive applications.</p>

# DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

## PROGRAMME EDUCATIONAL OBJECTIVE (PEO)

1. To offer thematic oriented teaching through practical engineering operation and make the students to learn from practice to be successful in their career.
2. To promote creative thinking to inspire the real world engineering design based on demand through research and development
3. To make the students to realize the importance of becoming entrepreneurs by promoting project design considering the product R&D, production, marketing, service aspects and product life cycle
4. To foster teamwork, communication, leadership and cultivate techno-commercial-socio-economic problem solving capabilities

## Program Outcomes

PO1 : Engineering knowledge : Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization for the solution of complex engineering problems.

PO 2 : Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 : Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PO4 : Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. PO 5 : Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO 6 : The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7 : Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.

PO 8 : Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9 : Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10 : Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

PO 11 : Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12 : Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **Program Specific Objective**

PSO1 : MODELING AND ANALYSIS : An ability to mathematically model and analyze the performance of Electrical machines, Control systems, Instrumentation systems, Power systems and Power Electronic systems.

PSO2 : DESIGN AND DEVELOPMENT : An ability to design the hardware and software requirements for the development of Electric drives, Automation systems and Embedded systems.

## **19EEM31 - TRANSFORMS, PROBABILITY AND RANDOM VARIABLES**

### **COURSE OUTCOMES**

*Upon successfully completing of this course the students will be able to demonstrate ability to*

- CO1** : *Analyze the Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.*
- CO2** : *Use the effective mathematical tools for the solutions of difference equations by using Z transform techniques for discrete time systems.*
- CO3** : *Solve the physical problems of engineering by using the mathematical principles on transforms.*
- CO4** : *Apply the basics of probability and random variables to solve engineering problems*
- CO5** : *Apply moments, probability density functions, correlation & regression to analyze and solve problems.*

## **19EE31- ELECTRIC CIRCUIT ANALYSIS**

### **COURSE OUTCOMES**

*After successful completion of this course, the students will be able to,*

- CO1** : *Apprehend the fundamentals of sinusoids, phasor and apply & analyse the sinusoidal excitation of R, L, C under steady state and associated power relations*
- CO2** : *Realize the concept of linearity and apply the circuit theorems to solve complex electric circuits.*
- CO3** : *Comprehend the frequency response of a resonant circuit and analyse the impact of quality factor, bandwidth on the frequency response.*
- CO4** : *Recognize and interpret the dot convention of mutually coupled coils in a circuit and solve complex electromagnetic circuits. Also understand nature of the waveform and its impact on the electrical systems*
- CO5** : *Describe the significance of three phase systems with star & delta connected circuits to solve the three phase circuits for both domestics and industrial applications*

## 19EE32 - ELECTROMAGNETIC FIELDS

### COURSE OUTCOMES

*After successful completion of this course, the students will be able to,*

- CO1** : *Solve electromagnetic field problems by using vector calculus concepts.*
- CO2** : *Illustrate Coulomb's law, Gauss law, Poisson and Laplace equation concepts to solve electrostatic problems.*
- CO3** : *Apply ampere's circuital law and Biot - Savart's law to determine magnetic field intensity and magnetic flux density in magneto static problems..*
- CO4** : *Determine the capacitance and inductance for various configurations in electrostatic and magnetostatic fields.*
- CO5** : *Analyze Maxwell's equations in different forms (differential and integral) and apply them to diverse engineering problems.*

## 19EE33 - DC MACHINES AND TRANSFORMERS

### COURSE OUTCOMES

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

- CO1** : *Elucidate the constructional details and analyze the operation of DC machines*
- CO2** : *Illustrate the speed control methods, braking and testing of DC machines for industrial application*
- CO3** : *Explain the construction of transformer and to compute the equivalent circuit parameters to evaluate its performance under various conditions.*
- CO4** : *Erudite the basic concept of three phase connections, principle of autotransformers and special purpose transformers.*
- CO5** : *Design of overall transformers and inductors for specific application.*

## 19EE34 - ANALOG ELECTRONICS

### COURSE OUTCOMES

*After successful completion of this course, the students will be able to,*

- CO1** : *Illustrate the rectifiers, filters and regulators of a DC power supply.*
- CO2** : *Analyze BJT and FET amplifiers using small signal models and to plot the frequency response of the amplifiers.*
- CO3** : *Design and evaluate different classes of power amplifiers used for audio and radio applications.*
- CO4** : *Utilize the concepts of negative feedback amplifiers to improve the stability of the amplifiers..*
- CO5** : *Apply the concepts of positive feedback amplifiers to generate sustained oscillations and to design clippers and clampers.*

## 19EE35 - DIGITAL ELECTRONICS

### COURSE OUTCOMES

After successful completion of this course, the students will be able to,

- CO1** : *Solve basic arithmetic calculations in binary, decimal and hexadecimal and illustrate reduction of logical expressions using boolean algebra, k-map and tabulation method and implement the functions using logic gates.*
- CO2** : *Realize combinational circuits for given application and design using logic gates*
- CO3** : *Design and analyze synchronous and asynchronous sequential circuits using flip-flops, able to develop Mealy and Moore Models and formulate the programming table for implementing the logic functions using PLA and PAL.*
- CO4** : *Compare different types of logic families which are the basic unit of different types of logic gates in terms of efficiency.*
- CO5** : *Develop Verilog coding for combinational and sequential logic circuits.*

## **19HSS01 - SCIENCE OF CREATIVITY AND PROFESSIONAL ETHICS**

### **COURSE OUTCOMES**

*After successful completion of course, students will be able to*

- CO1** : *Understand the principles of karma yoga, duty consciousness and evolution of the universe.*
- CO2** : *Analyze the benefits of yoga and meditation.*
- CO3** : *Understand the benefits of harmony, introspection and examine human values for sustained growth in career and life*

## **19EEL36 - DC MACHINES AND TRANSFORMERS LABORATORY**

### **COURSE OUTCOMES**

*After successful completion of this course, the students will be able to,*

- CO1** : *Analyze the performance of DC motors/generators by conducting direct load test experimentally.*
- CO2** : *Analyze the performance of transformer by conducting direct load test experimentally.*
- CO3** : *Predetermine the performance of DC machines by conducting Swinburne's test.*
- CO4** : *Compare the performance characteristics obtained experimentally on various DC machines and select suitable DC machines for industrial applications.*
- CO5** : *Draw the equivalent circuit and predetermine the performance of transformers by conducting open circuit and short circuit tests.*

## **19EEL37 - ANALOG AND DIGITAL ELECTRONICS LABORATORY**

### **COURSE OUTCOMES**

*After successful completion of this course, the students will be able to,*

- CO1** : *Design and construct simple electronic circuits to accomplish specific functions.*
- CO2** : *Observe the amplitude and frequency responses of common amplification circuits*
- CO3** : *Construct basic combinational circuits and verify their functionalities*

- CO4** : Design and simulate the combinational and sequential circuits  
**CO5** : Design and analyze the operation of counters and shift registers

## **19EE41 - AC ROTATING MACHINES**

### **COURSE OUTCOMES**

*After successful completion of this course, the students will be able to,*

- CO1** : Elucidate and illustrate constructional features, winding details, induced EMF of Synchronous Machines.
- CO2** : Analyze the performance of the three phase Synchronous motors and develop phasor diagram to examine steady state performance and determination of  $X_d$  and  $X_q$ .
- CO3** : Illustrate the operation and speed control characteristics PMSM and BLDC motors.
- CO4** : Acquire knowledge about the construction, torque slip characteristics and compute equivalent circuit parameters to evaluate the performance of three phase induction motors.
- CO5** : Interpret the double field revolving theory, analyze the performance and starting methods of single-phase induction motor.

## **19EE42 - NETWORKS AND SYSTEMS**

### **COURSE OUTCOMES**

*After successful completion of this course, the students will be able to:*

- CO1** : Solve circuit theory problems using graph theory concepts.
- CO2** : Appreciate the transient response of electric circuits with DC and AC excitation and solve transient circuits using Laplace Transform techniques.
- CO3** : Apply the concept of complex frequency in studying network functions and analyze two-port network parameters using various models.
- CO4** : Identify the given function for positive realness and synthesize LC, RC, and RL one-port networks using Foster and Cauer forms.
- CO5** : Apprehend the frequency response of active and passive filters.

## **19EE43 - MEASUREMENTS AND INSTRUMENTATION**

### **COURSE OUTCOMES**

*After successful completion of this course, the students will be able to*

- CO1** : Interpret statistical data measurement and evaluate static and dynamic characteristics for electrical and Non-electrical parameters measurement.
- CO2** : Illustrate the functioning of different electro-mechanical and digital measuring instruments along with their application domains.
- CO3** : Analyse and recommend suitable sensors and transducers for measuring non-electrical physical quantities and measurement techniques used in process industries.
- CO4** : Integrate the electronic display and recording devices for the appropriate type of measurement or data recording and logging.
- CO5** : Erudite about the intelligent sensors and data acquisition system in industry for effective measurement, control and data storage.

## 19EE44- LINEAR INTEGRATED CIRCUITS

### COURSE OUTCOMES

*After successful completion of this course, the students will be able to,*

- CO1** : *Examine the DC/AC characteristics of Op-amp and design an appropriate compensation for Op-amp.*
- CO2** : *Design of various linear applications using op-amp IC741.*
- CO3** : *Design of various non - linear applications using op-amp IC741.*
- CO4** : *Design of analog circuits such as voltage regulator, VCO and multi - vibrators using other linear IC's.*
- CO5** : *Design of analog computation and signal conditioning circuits using op-amps.*

## 19EE45 - TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER

### COURSE OUTCOMES

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

- CO1** : *Analyze HVAC and HVDC transmission, Overhead and underground transmission schemes, skin effect and earth capacitance, Compute the line parameters in single phase lines, three phase lines, bundled conductor lines and double circuit 3-ph lines.*
- CO2** : *Model the short, medium and long transmission lines by various methods and determine the performance under different loading conditions, Analyze about Ferranti effect, Corona effect, Tuned power lines and Critical voltages on transmission lines.*
- CO3** : *Understand the mechanical supports for transmission lines and types of insulators, Choose the number of insulators to improve the string efficiency of transmission lines, Compute sag and Tension in various types of transmission lines.*
- CO4** : *Illustrate the types of cables and Grading of cables, Compute the capacitance in single and three core cables, Locate the cable fault using loop tests.*
- CO5** : *Describe the types of substation and AC distribution system, Solve the AC distribution system problems and Tariff calculations for AC distribution systems.*

## 19EE46 - OOP AND C++ FOR ELECTRICAL ENGINEERS

### COURSE OUTCOMES

*After successful completion of this course, the students will be able to,*

- CO1** : *Distinguish object oriented Programming and traditional programming techniques*
- CO2** : *Develop, compile and debug programs*
- CO3** : *Illustrate key concepts such as encapsulation and polymorphism*
- CO4** : *Use files for reading and writing data*
- CO5** : *Write C++ program for practical electrical applications*

## 19EEL47 - AC ROTATING MACHINES LABORATORY

## **COURSE OUTCOMES**

- CO1** : *Analyze the performance of three phase and single-phase induction machines experimentally by direct and indirect methods.*
- CO 2** : *Select suitable AC machines for an industrial application by experimentally verifying the performance characteristics.*
- CO3** : *Predetermine the voltage regulation of alternator by EMF, MMF, Potier methods and Slip test experimentally.*
- CO4** : *Draw the V - curves and Inverted V - curves of synchronous motor*
- CO5** : *Draw the speed torque characteristics of BLDC motor and IoT based motor monitoring system*

## **19EEL48 LINEAR INTEGRATED CIRCUITS LABORATORY**

### **COURSE OUTCOMES**

*After successful completion of this course, the students will be able to,*

- CO1** : *Design and test waveform generators and various analog circuits for arithmetic operations using IC741 for the given specifications.*
- CO2** : *Design second order filters using IC741 and test their frequency response.*
- CO3** : *Design and test regulated power supply for the given specifications using IC723, IC7805.*
- CO4** : *Design and test ADC and DAC circuits for the given specifications using IC741 and arduino*
- CO5** : *Construct astable and monostable multivibrator using IC555 timer for the given specification.*

## **19EE51 - CONTROL SYSTEMS**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

- CO1** : *Appreciate the needs and effects of feedback in a control system; obtain the mathematical models of electrical and mechanical systems, and find transfer function through block diagram reduction and SFG.*
- CO2** : *Analyze the response of I order and II order systems using time-domain techniques.*
- CO3** : *Learn the stability concepts and finding the range of open loop gain for stability through various techniques.*
- CO4** : *Analyze the response of systems using frequency domain techniques.*
- CO5** : *Design compensators for the given system satisfying the given specifications.*

## **19EE52 - POWER SYSTEM ANALYSIS**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

- CO1** : *Mathematically model and assess the power system network under healthy and faulty conditions.*
- CO2** : *Apply mathematical methods to solve the load flow problems and interpret active and reactive power flows.*
- CO3** : *Identify the fault and assess the fault conditions using symmetrical components.*

**CO4** : *Illustrate the transient behavior of the power system network under open circuit and short circuited conditions.*

**CO5** : *Derive the equation to analyze the dynamics of power systems and examine the reliability of electric power systems.*

## **19EE53 - DATA STRUCTURES AND ALGORITHMS**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

**CO1** : *Examine data and define structures to organize large data*

**CO2** : *Use graphs and trees to support search applications*

**CO3** : *Describe how to analyze an algorithm, growth rate and decision making*

**CO4** : *Design new algorithms or modify existing ones for new applications and reason about the efficiency of the result*

**CO5** : *Develop the skills necessary to analyze algorithms that are used in a program.*

## **19EE54 -EMBEDDED SYSTEM DESIGN**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

**CO1** : *Interpret the register functionalities and architectural features of PIC18Fxxx microcontroller and ARM processor*

**CO2** : *Develop an assembly language program to process data and access on-chip hardware units using appropriate instructions and addressing modes.*

**CO3** : *Outline the organizational aspects of three stage pipeline execution process*

**CO4** : *Illustrate the processor operations by citing examples of pre-conditions and post- conditions, describing registers and memory before and after the instruction execution.*

**CO5** : *Develop an application software to interface various peripherals for the given design requirements*

## **19EEL55 - CONTROL SYSTEMS LABORATORY**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

**CO1** : *Derive the transfer function of a given system experimentally.*

**CO2** : *Design and verify the performance of lag/lead compensators in frequency/time domain.*

**CO3** : *Choose and design a suitable controller to meet the given specifications of an electrical system.*

**CO4** : *Analyze the system response in frequency/time domain using MATLAB software.*

**CO5** : *Design PID controller for second order systems and implement it using simulation software (Matlab/ LabView).*

## **19EEL56 - EMBEDDED SYSTEM DESIGN LABORATORY**

## **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

**CO1** : *Develop an Assembly Language Program for the given design requirements*

**CO2** : *Demonstrate the working of Timer/Counter Module using Assembly language program*

**CO3** : *Select suitable sensors to meet the given specification and interface it with the microcontroller to actuate certain output devices.*

**CO4** : *Experiment With PWM Technique*

**CO5** : *Appraise the use of interrupt driven programming over polling*

1. *ure/Moisture monitoring system.*

## **19EE61 - POWER ELECTRONICS**

### **COURSE OUTCOMES**

*After successful completion of this course, the students will be able to*

**CO1** : *Describe the role of Power Electronics as an enabling technology in various applications and to understand the characteristics of the power semiconductor devices.*

**CO2** : *Select the suitable power semiconductor device, based on the converter type and topology for the given specification and applications.*

**CO3** : *Ascertain the steady state operation of the power electronic converters based on different operational modes subject to continuous and discontinuous operations.*

**CO4** : *Seek and reach consensus on formulation of solution methodologies to design the power electronic converters for given applications.*

**CO5** : *Design, simulate, develop and evaluate the efficiency of power electronic systems such as motion control systems and power supplies for given specifications*

## **19EE62 - DIGITAL PROTECTION OF POWER SYSTEMS**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

**CO1** : *Summarize the need of digital protection and power system components, and the functional characteristics of different relays.*

**CO2** : *Illustrate the concepts of protection of machines, transformers and bus zone.*

**CO3** : *Recommend feasible Digital algorithmic solutions to various protection schemes of power system protection.*

**CO4** : *Apply the circuit breakers, fuses, and travelling wave concepts for transmission line protection.*

**CO5** : *Survey about AI-based numerical protection and recent trends to solve the problems encountered in the power system protection.*

## **19EE63 - DIGITAL SIGNAL PROCESSING**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

- CO1** : *Interpret and process the discrete/digital signals to perform various signal operations.*
- CO2** : *Perform statistical analysis and inferences on various types of signals.*
- CO3** : *Apply the principles of z-transforms and Fourier transform analysis for processing digital signals.*
- CO4** : *Realize IIR filter and FIR filter structures.*
- CO5** : *Employ digital signal processing techniques to design discrete time systems and digital filters*

## **19EEL64 - POWER ELECTRONICS LABORATORY**

### **COURSE OUTCOMES**

*After successful completion of this course, the students will be able to,*

- CO1** : *Apprehend the static and dynamic characteristics of the power semiconductor devices and their selection for a given application*
- CO2** : *Realize and develop the pulse width modulation techniques for power converters. Also Design and test the control and gate driver circuits for level triggered devices*
- CO3** : *Study and analyse the operation of the various types of the power electronic converters and to understand their performance parameters. Also to understand the usage of true RMS meters and Power Quality Analyzers for power electronic measurements.*
- CO4** : *Evaluate I - V & P - V characteristics, Estimate energy generation of solar PV modules and their applications*
- CO5** : *Simulate the power electronic converters using compatible software*

## **19EEL65 - POWER SYSTEMS LABORATORY**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

- CO1** : *Design and Select suitable Plug Setting Multiplier and test the over current protective relay using Electro - mechanical instrument*
- CO2** : *Identify and locate the fault in power system using cable fault locator*
- CO3** : *Analyze the IDMT characteristics of over/under voltage relay*
- CO4** : *Measure experimentally the negative sequence components in unbalanced systems*
- CO5** : *Analyze the harmonics in power system using MATLAB / Simulink & Perform various load flow techniques*

## **19EE71 - SOLID STATE DRIVES AND CONTROL**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

- CO1** : *Analyze the characteristics of motors, load dynamics and performance parameters of DC drives and selection of motor power rating under different load conditions.*

- CO2** : Outline the conventional method of DC drive and solid-state Drives for DC motors.
- CO3** : Infer the performance characteristics of three phase Induction motor and the various methods of speed control based on solid state drives
- CO4** : Summarize the concept of suitable power electronic circuitry to drive synchronous motor, brushless DC motor, special machines and SRM.
- CO5** : Formulate suitable drive according to industrial, environmental standards and develop the control schemes for any electric drive. Describe the concept and application of special machines in modern electric drives.

## **19EE72 - GENERATION OF ELECTRICAL ENERGY**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

- CO1** : Classify different types of loads and calculate the load demand - supply curve.
- CO2** : Identify the areas of agreement and disagreement in safety aspects and environmental concern of conventional power generation schemes.
- CO3** : Design solar PV based grid tied, off grid and hybrid systems for domestic applications.
- CO4** : Examine the possibilities of wind energy systems in the particular locality.
- CO5** : Assess the various sources of availability to design a microgrid for a given requirements.

## **19EE73 - SMART GRID**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

- CO1** : Explain the basic concepts of smart grid , its components, architecture and distinguish from traditional grid
- CO2** : Identify suitable power electronic converters for WAMPCS and select appropriate compensation methods for solar PV, micro - hydro, wind and battery storage connected micro - grids
- CO3** : Diagnose and control the grid quality using different communication algorithms / systems and security concerns
- CO4** : Summarize various metering services in smart grid & outline the concepts of attacks in metering
- CO5** : Decide smart grid pathway through various case studies

## **19EEL74 - ELECTRICAL DRIVES LABORATORY**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

- CO1** : Decide a suitable drive for a particular application based on power rating and characteristics of the application
- CO2** : Determine the braking characteristics of DC shunt motor and Induction motor
- CO3** : Assess the converter topologies, inverter topologies control principles and modern tools used in

*DC drives, AC drives and special electric drives*

- CO4** : *Demonstrate the speed control of DC motors by using converters and chopper fed drive and also to demonstrate the speed control of AC motors by using inverter fed AC drive*
- CO5** : *Integrate the drive-based energy saving technique through experimental verification and to perform the speed control techniques for special electric machines by using drive*

## **19EEL75 - PROFESSIONAL COMPETENCY**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

- CO1** : *Demonstrate knowledge in the program domain.*
- CO2** : *Develop the problem solving skill by analyzing the given criteria*
- CO3** : *Present views cogently and precisely*
- CO4** : *Exhibit professional etiquette suitable for career progression.*
- CO5** : *Prepare the students to face the competitive examinations and interview*

## **19EEE11 - ENERGY STORAGE TECHNOLOGY**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

- CO1** : *Infer the need Energy storage and compare various energy storage methods*
- CO2** : *Categorize the types of batteries and relate their usage for different applications by a proper mode*
- CO3** : *Analyze different electric , magnetic & thermal energy storage systems and relate those in various applications..*
- CO4** : *Select a suitable PCM for Energy storage and conservation*
- CO5** : *Explain the working of fuel cells, flywheel and evaluate the energy storage technologies for power plant and heating applications.*

## **19EEE13 - ELECTRICAL SAFETY**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

- CO1** : *Identify and analyze the precautions and protection of electrical hazards*
- CO2** : *Select and use the suitable personal protective equipment according to the working environment*
- CO3** : *Interpret the safety procedures for the specific work place*
- CO4** : *Analyze and apply the various grounding techniques*
- CO5** : *Infer the electrical safety against low voltage and high voltage and to manage the medical equipments*

## 19EEE14 - ENERGY EFFICIENT LIGHTING SYSTEMS

### COURSE OUTCOMES

*After completing the course successfully, the students will be able to,*

- CO1** : *Understand the properties of light, importance of lighting in various fields, types of light sources and methods of lighting.*
- CO2** : *Perform the calculation of luminance parameters in various applications.*
- CO3** : *Identify the criteria for selection of lighting equipment's and control systems in various applications.*
- CO4** : *Impart design and technology for Interior lighting and Exterior lighting applications*
- CO5** : *Review the various technologies used in Smart lighting systems.*

## 19EEE24 - DIGITAL CONSUMER TECHNOLOGY

### COURSE OUTCOMES

*After completing the course successfully, the students will be able to,*

- CO1** : *Describe the concepts of audio, video and digital display devices*
- CO2** : *Outline the working of digital display devices*
- CO3** : *Categorize the digital devices for internet and PC and analyze their applications*
- CO4** : *Identify applications of the domestic digital devices*
- CO5** : *Assess the usage of emerging consumer devices for industrial applications*

## 19EEE26 - MEDICAL ELECTRONICS

### COURSE OUTCOMES

*After completing the course successfully, the students will be able to,*

- CO1** : *Differentiate and analyse the biomedical signal sources.*
- CO2** : *Elucidate cardiovascular system and related measurements.*
- CO3** : *Explain the brain, respiratory and nervous systems and related measurements*
- CO4** : *Measure non-invasive diagnostic parameters.*
- CO5** : *Recommend problem solving and service procedures for safety use of medical instruments as per medical standards.*

## 19EEE33 - FOG COMPUTING

### COURSE OUTCOMES

*After completing the course successfully, the students will be able to,*

- CO1** : *Describe the knowledge in systems, protocols and mechanisms which supports fog computing*
- CO2** : *Illustrate major security and privacy problems in the fog computing scenarios and how they are addressed with the security mechanisms.*

**CO3** : *Identify the high level architecture of fog computing models.*

**CO4** : *Formulate the cloud providers and software platforms.*

**CO5** : *Design and implement a computing applications novel fog*

## **19EEE34 - INTERNET OF THINGS (IoT)**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

**CO1** : *Identify the architecture, emerging industrial infrastructure and challenges involved in deployment of IoT.*

**CO2** : *Interpret the use of devices, gateways and hardware design constraints in IoT.*

**CO3** : *Describe the design principles to realize enterprise integrated Web of Things*

**CO4** : *Demonstrate the technical design constraints involved in IoT based industrial automation*

**CO5** : *Apply the application of IoT in Industrial and Commercial Building Automation*

## **19EEE35 - DATA ANALYTICS**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

**CO1** : *Identify big data and its analysis techniques.*

**CO2** : *Apply Probability and Statistics in Data Analysis*

**CO3** : *Analyze the data for machine learning algorithms.*

**CO4** : *Justify the performance measure of algorithms using Python language*

**CO5** : *Identify appropriate data in real life applications*

## **19EEE36 -VIRTUAL INSTRUMENTATION**

### **COURSE OUTCOMES**

*After completing the course successfully, the students will be able to,*

**CO1** : *Summarize the fundamental concepts of Digital and Virtual Instrumentation.*

**CO2** : *Compare the interfacing of RS232, RS 422, RS 485 and USB standards with PC.*

**CO3** : *Recall the concepts of various bus protocol implementations in virtual instrumentation.*

**CO4** : *Choose the data acquisition components for the given application.*

**CO5** : *Develop and emulate the real-time hardware applications virtually using LabVIEW Software.*