Automobile Engineering

Department Name: -Automobile Engineering

- **UG Program Name: - B.Tech. Mechanical Engineering Automobile & B.Tech. Automobile Engineering**
- **Vision and Mission: -**

Vision - To offer programs of global repute with an emphasis on academics, research and innovation to provide competent and efficient human resources in the field of automotive engineering to fulfil the needs of the society.

Mission –

1. To design and enrich the curricula based on changing needs of industry and society.
2. To develop a center of excellence to promote automotive research and attract industry assignments.
3. To provide an excellent academic environment for development of competent automotive professionals to meet industry expectations.
4. To ensure participation of every stakeholder to enhance effectiveness of the programs being offered.

Sr. No.	Program Outcomes
1.	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2.	Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences
3.	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.	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 for complex problems
5.	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.	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.	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
8.	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
9.	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
10.	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.	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.	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change

Sr. No.	Program Specific Outcomes
1.	Diagnose the automotive system failures and repair / replace the components / systems so as to bring the vehicle in original condition.
2.	Perform the role of motor claim approver and loss assessor with confidence and competence.

S. Y. B. Tech. (Mechanical Engineering Automobile)

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	IV	SH2032	Engineering Mathematics – III	Co:1 Solve mechanical engineering problems using Linear Differential Equations
				Co:2 Apply Partial Differential Equations to various engineering problems.
				Co:3 Solve Engineering problems using Laplace Transform.
				Co:4 Apply knowledge of vector differentiation to find directional derivatives, curl, and divergence of vector fields.
				Co:5 Evaluate Fourier transforms and apply it to solve heat conduction problems in engineering
2.	III	MA201	Applied Thermodynamics	Co:1 Explain energy, heat, and work interaction.
				Co:2 Use steam table and Mollier chart to compute thermodynamics interactions.
				Co:3 Apply laws of thermodynamics to various flow and non-flow thermodynamic processes.
				Co:4 Analyze the performance of various power cycles.
				Co:5 Describe various methods of refrigeration and air conditioning.
3.	III	MA203	Engineering Mechanics	Co: 1 Classify various forces and their effects to analyze real-life problems.
				Co:2 Analyze engineering problems applying conditions of equilibrium.
				Co:3 Apply fundamental concepts of kinematics and kinetics to the analysis of practical problems.
				Co:4 Determine centroid & moment of inertia of the geometrical plane lamina.
4.	III	**MA205**	Manufacturing Technology	Co:1 Select material, types, allowances of pattern in the casting process
				Co:2 Explain casting equipment and casting defects
				Co:3 Explain various machine tools and machining operations
				Co:4 Develop part programing for CNC machine
5.	III	MA207	Material Science & Metallurgy	Co:1 Classify engineering materials based on properties.
				Co:2 Describe crystalline characteristics of engineering materials.
				Co:3 Illustrate different phases of materials.

				Co:4 Select suitable heat treatment or mechanical testing for desired material properties.
				Co:5 Select appropriate material for a particular application.
6.	III	SH2173	Environmental Science	Co:1 Explain the importance and sensitivity of the environment.
				Co:2 Interpret the over exploitation of natural resources and follow environmental ethics.
				Co:3 Explain methods to protect the environment and prevent environmental pollution
				Co:4 Apply their knowledge and skills to solve their environment-related problems.
7.	III	MA209	Workshop Practice – I	Co:1 Demonstrate the tool grading and lathe machine.
				Co:2 Perform turning, parting, knurling, and threading operations on lathe.
				Co:3 Demonstrate milling, grinding, and shaping machines.
8.	III	MA211	Engineering Mechanics Lab.	Co:1 Verify law of polygon of forces, law of triangle of forces, and principle of moment.
				Co:2 Compare coefficient of friction of various surfaces in contact.
				Co:3 Correlate theoretical and practical results of support reactions and centroid of plane lamina.
				Co:4 Analyze a simple truss
9.	IV	MA213	Machine Drawing Lab.	Co:1 Represent the automotive and mechanical components and materials with their conventions.
				Co:2 Develop an ability to prepare free hand sketches with proportionate dimensions.
				Co:3 Apply AutoCAD or similar software for drawing machine components and assemblies.
				Co:4 Develop an ability to prepare detail and assembly drawings as per standard procedure.
10	III	MA215	Technical Aptitude-I	Co:1 Comprehend the knowledge gained in the course work.
				Co:2 Demonstrate the problem-solving ability.
11	III	SH2603	Environmental Science Project	Co:1 Utilize scientific methods to solve environmental problems.
				Co:2 Evaluate technologies for restoration of degraded environment.
				Co:3 Develop presentation and report writing skills.
				Co:4 Develop as an individual and in group leadership quality.
12.	III	SH2633	Professional Leadership Skills	Co:1 Exhibit the ability to work effectively in a team.
				Co:2 Describe the traits of a leadership through real-life examples.

				Co:3 Plan the speech as per the audience and context requirements.
				Co:4 Analyze public speeches.
13.	III	SH2613	Interpersonal Skills [‘Jeevanvidya’ for Work Life Balance]	Co:1 Exhibit interpersonal communication skills.
				Co:2 Demonstrate decision-making skills.
				Co:3 Apply conflict resolution styles appropriate in different situations.
				Co:4 Demonstrate leadership skills.
14.	III	SH2693	Innovation Tools and Methods for Entrepreneurs	Co:1 Learn a structured approach to define the problem with every possible detail, identify conflicts and solve them
				Co:2 Apply User Journey Map to the selected problem to show user interaction at various stages
				Co:3 Analyse the solutions provided by competitors for effectiveness and gaps if any.
15.	III	SH2593	Personal Effectiveness and Body Language	Co:1 Develop skills to build self-esteem and positive attitude.
				Co:2 Discover ways to overcome procrastination.
				Co:3 Demonstrate responsiveness towards stress and health issues.
				Co:4 Interpret the non-verbal behavior of a person.
16.	III	SH2733	German Language - Basic Level	Co:1 Introduce herself or himself in German.
				Co:2 Can listen and understand alphabets, numbers in German language.
				Co:3 Make basic and easy sentences required in day to day situations
				Co:4 Read, write, speak, and listen basic and simple text in German.
17.	III	SH2713	Japanese Language - Level III	Co:1 Acquaint with foreign language.
				Co:2 Acquire knowledge of basic Japanese grammar
				Co:3 Acquaint basic Japanese language skills (listening, speaking, writing, and reading).
				Co:4 Aware relevance of Japanese language to professions and careers.
				Co:5 Aware cultures and civilizations of the country of Japan.
				Co:6 Aware of environment where Japanese is used exclusively.
18.	IV	MA202	Kinematics of Machines	Co:1Design suitable mechanism for different applications in a machine
				Co:2 Determine velocity and acceleration of linkages in mechanisms using graphical and analytical methods.
				Co:3 Develop profile of the cam to get required follower motion for given application.
				Co:4 Analyze characteristic curves of mechanical governors for their stability.

				Co:5 Select the lower pair mechanisms for a given application.
				Co:6 Use principles of friction in designing automotive components such as clutch, brake, and bearing.
19.	IV	MA204	Fluid Mechanics & Machinery	Co:1 Compare various properties of fluids at rest and in transit.
				Co:2 Analyze fluid systems using equations such as Bernoulli's equation and Continuity equation.
				Co:3 Examine energy losses in pipes to enable drawing energy gradient lines.
				Co:4 Solve viscous and boundary layer flow problems.
				Co:5 Evaluate the performance characteristics of hydraulic turbines.
				Co:6 Evaluate the performance characteristics of hydraulic pumps.
20.	IV	MA206	Electric Drives and Controls	Co:1 Explain the importance and working of electric drives.
				Co:2 Analyze performance of DC & AC machines.
				Co:3 Explain conventional & static DC & AC drives for speed control.
				Co:4 Describe steeper & servo motor and its drive system along with applications.
21.	IV	MA208	Mechanics of Materials	Co:1 Apply knowledge of stresses and strains for structural analysis.
				Co:2 Analyse suitability of appropriate section for mechanical applications.
				Co:3 Compare different columns based on end conditions.
				Co:4 Analyze the circular shaft subjected to pure torsion.
				Co:5 Apply energy method for structural analysis of solid body.
22.	IV	MA210	Industrial Organisation and Management	Co:1 Explain the basic functions of management.
				Co:2 Describe the basic concepts of functional areas of management.
				Co:3 Apply basic concepts of management in an industry
				Co:4 Acquaint with Entrepreneurship management
23.	IV	MA212	Metrology & Measurement Lab.	Co:1 Measure surface finish by using Autocollimator.
				Co:2 Measure angle of tapered components, template & thread form using tool maker's microscope, sine bar and with standard balls and rollers
				Co:3 Measure pressure, force, velocity, etc by using various instruments
				Co:4 Calibrate the measuring instruments
24.	IV	MA 214	Fluid Mechanics & Machines Lab.	Co:1 Verify and apply Bernoulli's Theorem.
				Co:2 Calibrate different apparatus of fluid flow measurement.

				Co:3 Calculate various losses through pipes.
				Co:4 Draw performance characteristic curves for pumps, compressors, and turbines.
				Co:5 Evaluate various efficiencies of pumps, compressors and turbines.
25.	IV	MA216	Solid Modeling Lab.	Co:1 Develop base features for modeling of parts.
				Co:2 Develop 3D model of automotive components.
				Co:3 Assemble components using functional constraints.
				Co:4 Prepare production drawings in drafting workbench
26.	IV	MA218	Workshop Practice - II	Co:1 Perform different welding processes namely metal inert gas (MIG) welding, tungsten inert gas (TIG) welding, plasma arc cutting, and submerged arc welding (SAW).
				Co:2 Perform different sheet metal operations (Marking, Punching, Bending, and finishing).
				Co:3 Perform CNC operations as per given drawing.
				Co:4 Perform 3D printing operations.
				Co:5 Demonstrate Electrical Discharge Machining (EDM) processes.
27.	IV	MA220	Object-Oriented Programming Lab.	Co:1 Identify elements and features of object-oriented programming.
				Co:2 Implement various object-oriented concepts with the help of programs.
				Co:3 Apply the object-oriented concepts in real-time problem-solving.
				Co:4 Apply template and exception handling techniques in dealing with variety of programs.
28.	IV	MA222	Technical Aptitude-II	Co:1 Comprehend the knowledge gained in the course work.
				Co:2 Demonstrate problem-solving ability.
29.	IV	SH2643	German Language - Advanced Level	Co:1 Introduce herself or himself in German.
				Co:2 Listen and understand alphabets, numbers in German language.
				Co:3 Make basic and easy sentences required in day to day situations
				Co:4 Read, write, speak, and listen basic and simple text in German.
30	IV	SH2623	Japanese Language - Level IV	Co:1 Acquainted with foreign language.
				Co:2 Gain knowledge of basic Japanese grammar.
				Co:3 Acquire basic Japanese language skills (listening, speaking, writing, and reading).
				Co:4 Demonstrate an awareness of the relevance of Japanese language to professions and careers.

				Co:5 Understand the cultures and civilizations of the country of Japan.
				Co:6 Function in an environment where Japanese is used exclusively.

T. Y. B. Tech. (Mechanical Engineering Automobile)

Sr.No.	Semester	Course code	Course Name	Course Outcomes
1	V	MA301	Internal Combustion Engines	CO:1 Perform a primary thermodynamic analysis of Otto and diesel cycle engines.
				CO:2 Select appropriate engine for specific application.
				CO:3 Select proper fuel system for IC engine.
				CO:4 Conduct performance test of IC engine and portray operating characteristics of engine.
				CO:5Identify abnormal combustion in engine and remedy over it.
				CO:6 Select proper lubrication, intake, exhaust, cooling system for engine.
2	V	MA303	Dynamics of Machines	CO:1 Analyze kinematic parameters of gears in mesh for typical power transmission application.
				CO:2 Explain the effect of gyroscopic effect on naval ship, aero plane etc.
				CO:3 Determine dynamic forces and torques acting on reciprocating engine mechanism.
				CO:4 Analyze rotating and reciprocating components of machines to compute the magnitude and direction of balancing mass.
				CO:5 Formulate mathematical models of systems and determine the natural frequency of undamped and damped free vibrations of single degree freedom systems.
				CO:6 Determine the response of vibrating systems under forced harmonic excitations.
3	V	MA305	Heat Transfer	CO:1 Compute temperature distribution using steady-state and unsteady-state heat conduction.
				CO:2 Analyze heat transfer through extended surfaces.
				CO:3 Analyze forced and free convection heat transfer situations.
				CO:4 Apply the principles of radiation heat transfer to engineering problems.
				CO5: Design heat exchangers using LMTD and NTU methods.
4	V	MA307	Automotive Systems	CO:1 Explain constructional details and operation of the automotive systems.
				CO:2 Interpret the influence of various technical parameters on the behavior of the automotive systems.
				CO:3 Configure the systems and its elements for integrating into drivetrain/chassis systems appropriate for given automotive application.
				CO:4 Present in detail the technological advancements of the automotive systems.

5	V	MA309	Autotronics	CO:1 Demonstrate the use of electronics in automotive system
				CO:2 Illustrate engine management system and justify the use of electronics in it
				CO:3 Describe various sensors and actuators required for automobiles
				CO:4 Illustrate the applications of advanced automotive technologies embedded with electronics
				CO:5 Explain the technologies used for alternately propelled vehicles.
6	V	MA323	I. C. Engine Lab.	CO:1 Demonstrate the fuels supply, lubrication, cooling systems.
				CO:2 Conduct the test on single cylinder and multi-cylinder petrol & diesel engines
				CO:3 Plot the engine performance characteristics curves and interpret the curves.
				CO:4 Calculate B.P., I.P., F.P., air/fuel ratios, and various engine efficiencies.
				CO:5 Conduct the test and prepare heat balance sheet.
7	V	MA325	Thermal Engineering Lab.	CO:1 Apply laws of heat transfer in conduction, convection and radiation domain.
				CO:2 Compute effectiveness of heat exchangers.
				CO:3 Determine effectiveness of pin fin.
				CO:4 Evaluate COP of Refrigeration and air conditioning system.
8	V	MA327	Automobile Engineering Lab.	CO:1 Describe the operating principle, functions, and constructional details of suspension, steering, braking & transmission systems used in automobiles.
				CO:2 Apply the concepts of human ergonomics for design of automobile.
				CO:3 Explain the use of various tests for designing the vehicle body.
				CO:4 Test the working of various electrical components using testing instruments.
9	V	MA329	Theory of Machines Lab	CO:1 Design a gear tooth profile for given engineering application.
				CO:2 Determine Gyroscopic couple and verify Gyroscopic law.
				CO:3 Plot polar diagram based on the experimental readings on Hook's joint.
				CO:4 Design a cam profile for given application.
				CO:5 Plot characteristic curves for centrifugal governors
				CO:6 Determine moment of inertia of rigid bodies.
				CO:7 Apply balancing methods to balance rotating and reciprocating masses.
				CO:8 Analyze vibration characteristics of single degree of freedom systems.
				CO:9 Determine critical speed of shafts.

10	V	MA331	Comprehensive Exam-III	CO:1 Comprehend the knowledge gained in the course work.
				CO:2 Demonstrate problem-solving ability.
11	V	SH3032	Aptitude Training I	CO:1 Develop a thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning problems.
				CO:2 Understand usage of basic aptitude terms of percentages, averages, ratios, and applications of business aptitude terms of profits and interests
				CO:3 Develop a bridge in analogies, series, and visualizing directions.
				CO:4 Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams.
12	V	MA333	Summer Internship	CO:1 Acquaint with garage environment and processes to be carried out.
				CO:2 Handle various tools and equipments used in garages.
				CO:3 Diagnose minor faults of vehicle.
				CO:4 Summarize the uses of advanced tools and equipments.
				CO:5 Communicate and present his ideas/work in front of peers and superiors.
13	V	SH3012	Indian Constitution	CO:1 Create awareness about law depiction and importance of Constitution
				CO:2 Define Fundamental Rights and Fundamental Duties of the Indian Citizen to instill morality, social values, honesty, dignity of life, and their social Responsibilities.
				CO:3 Create Awareness of their Surroundings, Society, Social problems, and their suitable solutions while keeping rights and duties of the citizen keeping in mind.
				CO:4 Recognize distribution of powers and functions of Local Self Government.
				CO:5 Comprehend the National Emergency, Financial Emergency, and their impact on Economy of the country.
14	V	MA311	Product Design and Development	CO:1 Describe the product development process in general.
				CO:2 Plan the proposed product and establish its specifications.
				CO:3 Generate, screen and test concepts for proposed product.
				CO4: Apply various techniques like industrial design, DFx for developing a product.
				CO5: Perform economic analysis of proposed product.
15	V	MA313	Tribology	CO:1 Describe the theories of friction and wear mechanisms.
				CO:2 Apply principle of hydrodynamic lubrication for designing bearing.

				CO:3 Analyse and optimize the hydrostatic bearing for minimum energy loss.
				CO:4 Apply Reynolds equation for designing gas lubrication system.
				CO:5 Select appropriate surface treatment for minimum wear and high corrosion resistance.
16	V	MA315	Fuels and combustion	CO:1 Write the properties and measurement techniques of various types of fuels.
				CO:2 Describe the processing and handling of various types of fuels
				CO:3 Describe various parameters that are utilized to characterize fuels and its combustion process.
				CO:4 Identify the utilization of combustion devices for appropriate application.
17	V	MA317	Welding and Joining Technologies	CO:1 Describe various joining processes, their significance & applications.
				CO:2 Select appropriate welding process for particular joining operation.
				CO3: Compare different welding processes to analyse suitability of a particular welding process for variety of applications.
				CO:4 Select appropriate Non-Traditional Machining Processes for particular application
18	V	MA319	Transport management	CO:1 Describe the motor vehicle act & central motor vehicle rules.
				CO:2 Illustrate motor vehicle insurance & taxation.
				CO:3 Analyze the passenger & goods transport operations.
				CO4: Identify advanced techniques in traffic management.
19	V	MA321	Industrial Engineering	CO:1 Apply industrial engineering tools to improve productivity
				CO:2 Decide plant lay out and suitable material handling system.
				CO3: Examine work measurement and inventory control techniques
				CO4: Plan production activities using tools like PPC, Capacity and Aggregate planning
20	VI	MA302	Design of Machine Elements	CO:1 Discuss steps of design and theories of elastic failure.
				CO:2 Design joints for different loading conditions.
				CO:3 Design shafts keys and couplings to transmit required amount of torque and power.
				CO:4 Design four types of gears namely spur, helical, bevel and worm by using different considerations.
				CO:5 Design components like spring and levers.

21	VI	MA304	Electric and Hybrid Electric Vehicles	CO:1 Articulate the need of EVs and HEVs in today's transportation context.
				CO:2 Design an electric vehicle for given requirements.
				CO:3 Design a hybrid electric vehicle for given requirements.
				CO:4 Elaborate fuel cell technology for vehicular application.
22	VI	MA306	Automotive Safety and Ergonomics	CO:1 Discussthe basics of vehicle collision and its effects.
				CO:2 Summarize the various safety concepts used in passenger cars.
				CO:3 Explain use of ergonomics in automotive design.
				CO:4 Explain the human response to impact.
				CO:5 Explain the use of various systems used in automobiles for safety & ergonomic considerations.
23	VI	SH302	Biology for Engineers	CO:1 Apply biological engineering principles, procedures needed to solve real-world problems
				CO:2 Demonstrate the functions of biological systems
				CO:3 Analyze biological phenomena with math and physics to gain important insights
				CO:4 Explain working of different biomedical instruments
				CO:5 Select the sensors for given biological applications
				CO:6 Explain relevant aspects of movement control process.
24	VI	MA320	Automotive Diagnostic Lab.	CO:1 Carry out engine tune-up.
				CO:2 Illustrate the critical inspection parameters while engine top overhaul.
				CO:3 Measure wear of engine components.
				CO:4 Perform wheel balancing and wheel alignment.
				CO:5 Test spark plug and fuel injector performance as per their specification.
				CO:6 Overhaul clutch, gearbox, braking system, electrical system, differential and axles.
25	VI	MA322	Advance Modeling Lab	CO:1 Develop surface models in modeling software.
				CO:2 Design sheet metal components.
				CO:3 Simulate the working of systems.
				CO:4 Design mold for plastic component manufacturing.
26	VI	MA324	Comprehensive exam-IV	CO:1 Comprehend the knowledge gained in the course work.
				CO:2 Demonstrate problem-solving ability.
27	VI	MA326	Capstone Project phase-I	CO:1 Carry out literature survey and identify as well as select a problem.

				CO:2 Comprehend and analyze an engineering problem and report findings to provide an appropriate solution.
				CO:3 Design an experimental setup or develop an analytical model to analyze the system under consideration.
				CO:4 Communicate problem, methodology and outcomes systematically and effectively in the form of a technical report.
				CO:5 Work as a member and a team leader in engineering teams / multidisciplinary teams.
				CO:6 Demonstrate an ability to use different tools and techniques to solve the given problem.
				CO:7 Demonstrate ethical behavior while completing the project work within given constraints and while delivering the expected outcomes.
28	VI	SH3052	Aptitude training- II	CO:1 Develop a thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning Problems
				CO:2 Understand usage of aptitude terms of speed, time and distance and permutations, probabilities, and applications.
				CO:3 Understand blood relations and ways of seating arrangements along with various geometrical figures
				CO:4 Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams.
29	VI	MA308	Automotive Emission and Control Technologies	CO:1 Outline the overview of emission control technologies in SI engine.
				CO:2 Explore effect of engine design parameters and engine operating variables on SI engines.
				CO:3 Analyse the pollutant formation mechanisms in IC engine emissions.
				CO:4 Illustrate the knowledge of emission norms, standard test procedures and emission measurements techniques.
				CO:5 Analyse different emission control technologies in IC engines.
30	VI	MA310	Sensor and Actuators	CO:1 Illustrate the construction and working of various automotive sensors and actuators.
				CO:2 Select suitable sensor for automotive applications.
				CO:3 Select suitable actuator for automotive applications.
				CO:4 Describe the diagnostics tools and equipments used for testing of electronic components, sensors and actuators.
31	VI	MA312	Advanced Manufacturing Processes	CO:1 Select suitable surface treatment processes for particular application.

				CO:2 Select appropriate advanced machining process for particular application.
				CO:3 Use various composite materials & ceramics in component manufacturing.
				CO:4 Compare traditional & advanced manufacturing processes.
32	VI	MA314	Advanced Materials	CO:1 Identify material demanding for extreme conditions
				CO:2 Make use of Smart, magnetic &nano-materials
				CO:3 Acquire knowledge of composite materials and polymers.
				CO:4 Suggest suitable material for particular application.
33	VI	MA316	Total Quality Management	CO:1 Apply principles and techniques of TQM to improve quality.
				CO:2 Plan and control the quality.
				CO:3 Test the reliability of product and system.
				CO:4 Apply TQM techniques in service sector.
34	VI	MA318	Supply Chain Management	CO:1 State the scope and practice of business logistics and supply chain management.
				CO:2 Explain the use of planning networks to manage flows.
				CO:3 Explain the use of inventory and warehousing for effective supply chain management.
				CO:4 Analyze the importance of transportation & packaging in supply chain management.
				CO:5 Explain the use of organizational structure of a company to control the effectively manage the supply chain.
35	VI	OE3023	Reliability Engineering	CO:1 Demonstrate an awareness about the concepts of Reliability, Availability and Maintainability.
				CO:2 Build system reliability models for different configurations.
				CO:3 Evaluate the reliability of simple and complex systems
				CO:4 Apply the appropriate methodologies to determine time and strength based reliabilities.
				CO:5 Implement strategies for improving reliability of repairable and non-repairable systems
36	VI	OE3043	Renewable Energy Sources	CO:1 Describe the challenges and problems associated with the use of various energy sources, including fossil fuels, concerning future supply and the environment
				CO:2 Describe the primary renewable energy resources and technologies.
				CO:3 Apply the knowledge of thermodynamic and heat transfer principles to evaluate the performance of

				energy conversion systems for maximum efficiency.
				CO:4 Compare the various renewable energy technologies.

inal Year B. Tech. (Automobile Engineering)

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1	VII	AE4012	Automotive System Design	Co:1 Design automotive clutch system for given automotive applications
				Co:2 Design gearbox for automotive application.
				Co:3 Design leaf spring and coil spring for automotive suspension.
				Co:4 Design braking system (Internal expanding shoe type) for a vehicle.
				Co:5 Design front axle, differential, propeller shaft & final drive for automotive application.
2	VII	AE4032	Vehicle Dynamics	Co:1 Evaluate vehicle acceleration performance & stability of vehicle over the range of operating conditions.
				Co:2 Determine braking performance of a vehicle when provided with specifications.
				Co:3 Evaluate the response of tires for various operating conditions.
				Co:4 Evaluate handling characteristics of a vehicle for a given set of data.
				Co:5 Apply ride concepts while designing a suspension system for a vehicle.
3	VII	AE4472	Vehicle Performance Evaluation & Emission Testing Laboratory	Co:1 Analyze performance of two and four wheelers using on road and laboratory testing methods.
				Co:2 Determine noise level in automotive systems using noise measurement systems.
				Co:3 Use vibration measurement system to determine vibration characteristics of automotive systems and components.
				Co:4 Analyze emission characteristics of petrol and diesel engines.
				Co:5 Select appropriate sensor for performance evaluation of vehicle and vehicle components.
4	VII	AE4632	Capstone Project Phase-II	Co:1 Demonstrate the ability to develop creative and original solutions to engineering problems of significant complexity.
				Co:2 Work as an individual member of a team, with support from a supervisor, formulating solutions to day-to-day problems by integrating knowledge and experience gained during the course and beyond that.
				Co:3 Demonstrate the ability to produce a formal engineering report.

				Co:4 Describe experimental apparatus and/or models, and analysis procedures in a clear, complete and unambiguous manner making best use of latest information technology.
				Co:5 Communicate and present his ideas / work in front of peers and superiors.
5	VII	AE4052	Design of Vehicle Operated Farm Equipments	Co:1 Apply the fundamental design concepts for the design of tractors and farm equipment.
				Co:2 Analyze the important supplementary systems in the tractors.
				Co:3 Select the different systems for a particular type of farm application.
				Co:4 Compare the performance of tractors related to various attachments.
6	VII	AE4072	Reverse Engineering	Co:1 Discuss terminologies related to re-engineering, forward engineering, and reverse engineering.
				Co:2 Describe Reverse Engineering methodologies.
				Co:3 Select a Reverse Engineering System for an automotive application.
				Co:4 Explain Reverse engineering of Systems, Mechanical RE.
				Co:5 Determine the geometry of the Automobile component.
				Co:6 Discuss aspects of Reverse Engineering.
7	VII	AE4092	Advanced Automotive Materials	Co:1 Suggest suitable modern materials and composites for automotive applications.
				Co:2 Explain various ferrous and nonferrous materials used in automobiles.
				Co:3 Explain various smart materials & polymers used in automobiles.
				Co:4 Suggest suitable materials for various automotive components.
8	VII	AE4112	Intelligent Transport System	Co:1 Recognise importance of ITS.
				Co:2 Differentiate different ITS user services.
				Co:3 Select appropriate ITS technology depending upon site specific conditions.
				Co:4 Design various ITS components for a specific operation.
9	VII	AE4132	Automotive Safety	Co:1 Apply the fundamental concepts of vehicle safety to modern automobiles.
				Co:2 Discuss European NCAP-Test for automobiles.
				Co:3 Select appropriate crash test to be carried out for any particular collision.
				Co:4 Evaluate the level of comfort in any vehicle by developing ergonomics report.
				Co:5 Predict appropriate dummy to be used for a specific crash test.
				Co:6 Explain advanced safety systems and driver assistance systems.

10	VII	AE4152	Dealership Management	Co:1 Prepare automotive dealership & showroom layout and its requirements.
				Co:2 Recognise the scope, functions and objectives of Logistics to solve Managerial issues.
				Co:3 Design maintenance documents and maintain automotive maintenance records.
				Co:4 Apply the concept of management in servicing and parts ordering.
				Co:5 Identify various strategies and innovations in selling skills.
11	VII	AE4172	Finite Element Methods	Co:1 Discretize the physical domain using appropriate elements.
				Co:2 Check the finite element model.
				Co:3 Develop FEA codes for analysis of structural problems.
				Co:4 Analyze thermal problems using FEA.
				Co:5 Use isoparametric formulation for irregular geometries.
12	VII	AE4192	Automotive NVH	Co:1 Demonstrate an awareness about fundamental concepts of noise and vibration necessary to understand noise and vibration mechanisms in engineering applications.
				Co:2 Formulate mathematical model for multi degree of freedom vibration system.
				Co:3 Select appropriate transducer for measurement of vibration in automotive / mechanical systems.
				Co:4 Analyze the automotive systems to characterize noise and vibration in them.
				Co:5 Apply methods for noise and vibration control in automotive applications.
13	VII	AE4212	Sheet Metal Manufacturing	Co:1 Describe different sheet metal operations.
				Co:2 Explain development of sheet metal pattern.
				Co:3 Describe joining operations of different thermal sheet metals.
				Co:4 Describe different sheet metal fastening methods.
				Co:5 Explain applications of sheet metal work.
14	VII	AE4232	Nano and Micro Technology	Co:1 Explain need and applications of nano and micro technology.
				Co:2 Select the suitable nano and micro machining and fabrication process.
				Co:3 Design and select industrially-viable processes, equipment and manufacturing tools for specific industrial products.
				Co:4 Elaborate use of nano and micro technology in various applications.
15	VII	AE4252	Automotive HVAC	Co:1 Design refrigeration system for refrigerated vehicle.

				Co:2 Apply psychometric concepts in design of HVAC of an automobile.
				Co:3 Analyze automotive HVAC system.
				Co:4 Explain troubleshooting methods and maintenance of automotive HVAC system.
16	VII	AE4272	Automotive Emission Control	Co:1 Outline the overview of emission control technologies in SI engine.
				Co:2 Explore effect of engine design parameters and engine operating variables on SI engines.
				Co:3 Analyse the pollutant formation mechanisms in IC engine emissions.
				Co:4 Illustrate the knowledge of emission norms, standard test procedures and emission measurements techniques.
				Co:5 Analyse different emission control technologies in IC engines.
17	VII	AE4292	Motor Vehicle Insurance Practices	Co:1 Discuss applications of insurance principles in vehicle insurance.
				Co:2 Describe various forms in motor vehicle insurance.
				Co:3 Discuss MACT in detail.
				Co:4 Analyze fraud management and internal audit in relation with motor vehicle insurance.
18	VIII	AE4312	Computational Fluid Dynamics	Co:1 Describe the physical significance of the governing equations for fluid dynamics and heat transfer.
				Co:2 Develop finite difference implicit & explicit algorithms for fluid flow and heat transfer problems.
				Co:3 Select appropriate grid generation methods for CFD analysis.
				Co:4 Develop finite volume algorithms for Steady and unsteady problems.
				Co:5 Select appropriate turbulent model for CFD simulation.
19	VIII	AE4332	Experimental Stress Analysis	Co:1 Use polariscope for finding stresses in machine component.
				Co:2 Analyze the photo elastic data by various methods.
				Co:3 Determine the strains and stresses in photo elastic coating by using reflection polariscope.
				Co:4 Use strain gauge for measurement of strain/stresses.
				Co:5 Design strain gauge transducers.
20	VIII	AE4352	Operations Research	Co:1 Illustrate the need to optimally utilize the resources in various types of industries.
				Co:2 Apply optimization techniques for the achievement of various objectives in the industry.
				Co:3 Apply cost effective strategies in various applications in industry.

				Co:4 Demonstrate skills to effectively manage the project within financial and time constraints..
21	VIII	AE4372	Inventory Management	Co:1 Describe the importance of information in inventory management.
				Co:2 Implement the just-in-time (JIT) method to manage inventory and production.
				Co:3 Explain the importance of stocks in the supply chain and within an organization.
				Co:4 Examine the methods for forecasting demand in inventory management.
22	VIII	AE4392	Special Purpose Vehicle	Co:1 Describe the construction & working of stratified charged/lean burn engines.
				Co:2 Describe the working of power trains in special propose vehicles and able to analyze the ride characteristics.
				Co:3 Describe the working of drive line in special propose vehicles and compared with commercial vehicles.
				Co:4 Describe the construction of farm equipments.
				Co:5 Apply the safety concepts for design special proposes vehicles.
23	VIII	AE4412	Vehicle Aerodynamics	Co:1 Apply basic principles of aerodynamics for the design of vehicle body.
				Co:2 Calculating lift and drag of automotive models.
				Co:3 Describe the physics of fluid flow over vehicle body and its optimization techniques.
				Co:4 Use of wind tunnels in testing the vehicles.
				Co:5 Apply computational fluid dynamics (CFD) tool for aerodynamics study.
24	VIII	AE4432	Reliability Centered Maintenance	Co:1 Comprehend the concepts of reliability centered maintenance
				Co:2 Describe basic scheduled maintenance tasks
				Co:3 Apply RCM program for vehicular system
25	VIII	AE4452	Transport Management	Co:1 Describe the motor vehicle act & central motor vehicle rules.
				Co:2 Illustrate motor vehicle insurance & taxation.
				Co:3 Analyze the passenger & goods transport operations.
				Co:4 Identify advanced techniques in traffic management.
26	VII	AE4492	Finite Element Methods Lab.	Co:1 Explain user interface of the software.
				Co:2 Develop appropriate functions required for simulation.

				Co:3 Apply proper constraints and boundary conditions.
				Co:4 Analyze structural and thermal problems using linear and higher order elements.
				Co:5 Apply different post processing techniques to interpret the results.
				Co:6 Optimize the codes to simulate the engineering problems.
27	VII	AE4512	Automotive NVH Lab.	Co:1 Demonstrate an awareness about basics of measurement and elements of measurement system.
				Co:2 Calibrate the transducers such as accelerometers, microphones and strain gauges.
				Co:3 Measure vibration characteristics using data acquisition system or vibrometer.
				Co:4 Measure noise sound pressure level using data acquisition system or sound level meter.
				Co:5 Design control strategies to reduce noise and vibration level in automotive and mechanical systems.
28	VII	AE4532	Sheet Metal Manufacturing Lab.	Co:1 Join two metals using advance welding technique.
				Co:2 Use sheet metal fabrication tools to prepare simple objects.
				Co:3 Prepare a process sheet for the given object.
				Co:4 Prepare the given object as per given shape and size.
29	VII	AE4552	Nano and Micro Technology Lab.	Co:1 Demonstrate and experiment advanced manufacturing techniques.
				Co:2 Select modern equipment and techniques for micro features.
				Co:3 Select tools and methodology for micro features.
				Co:4 Measure the physical properties of nanofluids.
30	VII	AE4572	Automotive HVAC Lab.	Co:1 Identify different components of Automotive Air Conditioning.
				Co:2 Select refrigerant for refrigerated vehicle.
				Co:3 Design refrigeration system for refrigerated vehicle.
				Co:4 Apply psychometric concepts in design of HVAC of an automobile.
				Co:5 Explain troubleshooting methods and maintenance of automotive HVAC system.
31	VII	AE4592	Automotive Emission Control Lab.	Co:1 Discuss vehicle emission norms.
				Co:2 Measure engine emission using gas and smoke analyzers.
				Co:3 Demonstrate emission reducing devices.
				Co:4 Demonstrate emission controlling devices.

32	VII	AE4612	Motor Vehicle Insurance Practices Lab.	Co:1 Comprehend the detailing of various forms to be used in insurance sector.
				Co:2 Carry out motor accident survey.
				Co:3 Prepare accident survey report.
				Co:4 Settle the claim of motor accident insurance.
33	VIII	OE438	Finance for Engineers	Co:1 Discuss the fundamental aspects of accounting and finance.
				Co:2 Apply rules of accounting while recording transactions.
				Co:3 Prepare financial statements and analyze financial position of the firm by applying various techniques.
				Co:4 Describe the various long term sources of finance available for the business organization.
34	VIII	OE436	Engineering Management & Economics	Co:1 Develop administrative, organizational and planning skills to execute engineering project.
				Co:2 Develop bar chart/mile stone chart for the project.
				Co:3 Analyze profit/cost data and carry out economic analysis to take optimal decision.
				Co:4 Calculate depreciation as per various methods.
35	VIII	IP4022	Internship & Project	**Internship**
				Co:1 Examine the functioning of the company on the terms of inputs, transformation process and the outputs (products and services).
				Co:2 Develop an attitude to adjust with the company culture, work norms, code of conduct.
				Co:3 Recognize and follow the safety norms, Code of conduct.
				Co:4 Demonstrate the ability to observe, analyse and document the details as per the industry practices.
				Co:5 Interpret the processes, systems and procedures and to relate to the theoretical concepts- studies.
				Co:6 Develop the leadership abilities, communication.
				Co:7 Demonstrate project management and finance sense.
				Project
				Co:1 Identify the project/problem in the domain of a program relevant for the company.
				Co:2 Compile the information to the pertaining to the problem identified.
				Co:3 Analyse the information using the statistical tools/ techniques.
				Co:4 Develop the feasible solution for given problem.

				Co:5 Analyse the impact of the project on the performance of company/department.
36	VIII	RE4042	Research Project	Co:1 Investigate the technical literature.
				Co:2 Recognize and evaluate theories, practices, and/or research on a chosen topic by conducting a thorough literature review and submitting a written integrative, critical summary of the current literature.
				Co:3 Design a research problem and develop a methodology.
				Co:4 Develop and implement an advanced original research or creative project.
				Co:5 Develop the ability to explain the conceptua l viability of the project and describe the major components involved.
				Co:6 Develop the ability to explain how the project will impact the relevant body of work.
				Co:7 Develop advanced discipline-relevant skills and competencies.
				Co:8 Construct an accurate record of research performed.
				Co:9 Write a research report and paper.
37	VIII	ED4102	Project Management	Co:1 Prepare business Plan for selected business.
				Co:2 Make risk analysis& market analysis of selected project.
				Co:3 Make risk analysis& market analysis of selected project.
				Co:4 Make financial appraisal of selected project.
38	VIII	ED4042	Commercial Aspects of the Project	Co:1 Interpret basic Financial Terminologies.
				Co:2 Prepare & analyze financial statements.
				Co:3 Prepare financial Plan for venture.
				Co:4 Apply basic principles of marketing for various products.
				Co:5 Prepare market survey.
				Co:6 Apply knowledge of marketing management for selected business.
39	VIII	ED4062	Entrepreneurship Development Program (EDP)	Co:1 Apply knowledge of engineering, economics, marketing and finance for formulation of business plan, starting & managing new business.
40	VIII	ED4082	Entrepreneurship Development Project	Co:1 Apply knowledge of engineering, economics, marketing and finance for preparation of project report.
				Co:2 Make commercial, technical and financial appraisal of project.

- **Department Name: -Automobile Engineering**
- **PG Program Name: - M.Tech. Automotive Technology & M.Tech. Mechanical Engineering Automobile**
- **Vision and Mission: -**

Vision - To offer programs of global repute with an emphasis on academics, research and innovation to provide competent and efficient human resources in the field of automotive engineering to fulfil the needs of the society.

Mission –

5. To design and enrich the curricula based on changing needs of industry and society.
6. To develop a center of excellence to promote automotive research and attract industry assignments.
7. To provide an excellent academic environment for development of competent automotive professionals to meet industry expectations.
8. To ensure participation of every stakeholder to enhance effectiveness of the programs being offered.

Sr. No.	Program Outcomes
1.	An ability to independently carry out research /investigation and development work to solve practical problems.
2.	An ability to write and present a substantial technical report/document.
3.	An ability to demonstrate a degree of mastery in Automotive Technology.
4.	An ability to collaborate, work harmoniously in teams and address multidisciplinary issues with consideration of professional, legal, and ethical issues.
5.	An ability to use advanced techniques, skills, and modern engineering tools with financial aspects.
6.	An ability to learn continuously, independently and update knowledge & skills.

M. Tech. (Automotive Technology)

Sr.No.	Semester	Course code	Course Name	Course Outcomes
1	I	MAT101	Vehicular Systems	CO:1 Explain fundamental concept of the various automotive systems
				CO:2 Discuss the functions of various automotive systems
				CO:3 Depict the various systems using simple schematics
				CO:4 Synthesize mathematical models of the various systems
2	I	MAT102	Finite Element Analysis	CO:1 Formulate finite element equation using weighted residual approach.
				CO:2 Formulate finite element equation using variational approach.
				CO:3 Analyze vector and scalar field problems using FEM.
				CO:4 Use isoparametric formulation for irregular geometries.
				CO:5 Analyze the dynamic behaviour of structure using FEM.
3	I	MAT103	Vehicle Dynamics and Control	CO:1 Calculate axle loads under any combination of accelerations, grades, aerodynamic forces etc.
				CO:2 Evaluate vehicle acceleration performance in the light of engine

				power constraint and traction limit constraints.
				CO:3 Determine braking performance of vehicle over the range of operating conditions.
				CO:4 Evaluate response of vehicle to steering inputs at low and high speeds and its characterization as understeer or oversteer.
				CO:5 Estimate ride performance of a vehicle in terms of resonant frequencies, bounce and pitch frequencies.
4	I	MAT112	Engine & Vehicle Testing Laboratory	CO:1 Describe the operating principle, functions, and constructional details of various engine systems.
				CO:2 Conduct the test on single cylinder and multi-cylinder petrol, diesel engine plot the characteristics curves and interpret the curves
				CO:3 Determine performance parameters of two & four wheelers
				CO:4 Determine vibration characteristics of automotive systems and components
				CO:5 Determine sound pressure level in an automobile.
				CO:6 Determine performance characteristics of automotive gear box.
				CO:7 Determine aerodynamic performance characteristics of car bodies.
5	I	MAT113	Modelling and Simulation Laboratory	CO:1 Develop/ select appropriate model required for simulation.
				CO:2 Apply proper constraints and boundary conditions.
				CO:3 Select suitable solver settings of simulation software.
				CO:4 Apply different post-processing techniques to interpret the results.
				CO:5 Apply optimization tools from simulation software..
6	I	SHP551	Technical Communication	CO:1 Acquire skills required for good oral and written communication.
				CO:2 Demonstrate improved writing and reading skills.
				CO:3 Ensure the good quality of oral and written communication.
7	I	MAT104	Alternative Fuels & Emissions	CO:1 Interpret and understand the essential properties, manufacturing

				techniques and use of liquid fuels in petrol and diesel engines.
				CO:2 Analyse the properties, characteristics and the implementation limits of gaseous fuels like LPG, CNG, and HYDROGEN in I.C engines.
				CO:3 Explain the formation of pollutants in SI and CI engine and describe the Emission control techniques.
				CO:4 Outline the emission measurement techniques and various test procedure
8	I	MAT105	Automobile Body Structure Design	CO:1 Apply concepts of aesthetics, ergonomics, and aerodynamics to design a vehicle body.
				CO:2 Design vehicle body structures as per requirements.
				CO:3 Select suitable materials for different body components.
				CO:4 Analyze different loading conditions applied on vehicle bodies.
9	I	MAT106	Industry 4.0 Technologies	CO:1 Illustrate the drivers and enablers of Industry 4.0.
				CO:2 Appreciate the smartness in Smart Factories, Smart cities, smart products and smart services.
				CO:3 Outline the various systems used in a manufacturing plant and their role in an Industry 4.0 world.
				CO:4 Appreciate the power of Cloud Computing in a networked economy.
				CO:5 Outline the opportunities, challenges brought about by Industry 4.0 and how organizations and individuals should prepare to reap the benefits.
10	I	MAT107	Automotive Product Design & Development	CO:1 Appreciate the product development process and life cycle in general.
				CO:2 Establish target and final specifications of proposed product.
				CO:3 Generate, screen and test concepts for proposed product.
				CO:4 Apply various tools and techniques like ID, DFx etc. for product development.
				CO:5 Perform economic analysis of proposed product.
11	I	MAT108	Automotive Safety	CO:1 Apply the fundamental concepts of vehicle safety to modern automobiles.
				CO:2 Discuss European NCAP-Test for automobiles.

				CO:3 Select appropriate crash test to be carried out for any particular collision.
				CO:4 Evaluate the level of comfort in any vehicle by developing ergonomics report.
				CO:5 Predict appropriate dummy to be used for a specific crash test.
				CO:6 Explain advanced safety systems and driver assistance systems.
12	I	MAT109	Automotive Ergonomics and Aesthetics	CO:1 Apply principles of anthropometry and ergonomics in design of automotive systems.
				CO:2 Design a vehicle control and operating system by automotive design standards with regard to ergonomics and aesthetics.
				CO:3 Design vehicle display, instruments, interior, occupant position for comfort.
				CO:4 Analyze the vehicle design on the basis of ergonomic and comfort level.
				CO:5 Generate vehicle models by use of techniques in multiple materials.
13	I	MAT110	Vehicle Aerodynamics	CO:1 Apply basic principles of aerodynamics for the design of vehicle body.
				CO:2 Calculate lift and drag of automotive models
				CO:3 Discuss the physics of fluid flow over vehicle body and its optimization techniques.
				CO:4 Use wind tunnels in testing the vehicles.
				CO:5 Apply computational fluid dynamics (CFD) tool for aerodynamics study.
14	I	MAT111	Tractors and Farm Equipments	CO:1 Describe constructional and operational features of the farm tractor.
				CO:2 Evaluate the various mechanizations used in the farm.
				CO:3 Analyse the operational features of farm machineries
				CO:4 Troubleshoot and carry out basic maintenance of tractors and Farm Equipment's
15	II	MAT114	Automotive Noise, Vibration and Harshness	CO:1 Demonstrate the significance of experimentation and explore the possibility of carrying out engineering investigations

				CO:2 Measure the various technical parameters by instrument and by mathematical relationship
				CO:3 Validate actual performance of the system experimentally
				CO:4 Analyze experimental test data for further improvement of the system
				CO:5 Identify the effect of various parameters on the system and co-relate them
16	II	MAT115	Hybrid and Electric Vehicles	CO:1 Describe the working principle of electric vehicles.
				CO:2 Explain the construction and working principle of various motors used in electric vehicles.
				CO:3 Discuss working principle of electronics and sensor less controls in electric vehicles.
				CO:4 Describe the different types and working principle of hybrid vehicles.
				CO:5 Illustrate the various types and working principle of fuel cells.
17	II	MAT124	Research Methodology & IPR	CO:1 Formulate a research problem.
				CO:2 Analyze research related information.
				CO:3 Use computing tools effectively.
				CO:4 Describe nature and processes involved in development of intellectual property rights.
				CO:5 Prepare and present research proposal/paper by following research ethics.
18	II	MAT125	Hybrid and Electric Vehicles Laboratory	CO:1 Interpret the impact of different design parameters on electric vehicle performance.
				CO:2 Explain the working principle of various motors used in electric vehicles.
				CO:3 Examine the performance different types of Hybrid power trains.
				CO:4 Describe the different types and working principle of hybrid vehicles.
19	II	MAT126	Automotive Noise, Vibration and Harshness Laboratory	CO:1 Demonstrate the significance of experimentation and explore the possibility of carrying out engineering investigations
				CO:2 Acquire hands on experience on the various test-rigs, experimental set up

				CO:3 Measure the various technical parameters by instrument and by mathematical relationship
				CO:4 Analyse experimental test data for further improvement of the system
				CO:5 Identify the effect of various parameters on the system and co-relate them
20	II	MAT127	Mini Project	CO:1 Identify a problem of small magnitude preferably in automotive domain.
				CO:2 Analyze the problem with certain objectives and within applicable constraints.
				CO:3 Offer/Suggest/Implement innovative solution to the said problem and validate the solution.
				CO:4 Communicate the effort through presentation, display and technical report.
21	II	MAT116	Automotive Electrical and Power Electronics	CO:1 Explain the various automotive sensors and actuators and their use in different automotive applications.
				CO:2 Differentiate various types of vehicle starting, charging system and ignition system.
				CO:3 Demonstrate the need and requirement of automobile batteries and its parameters.
				CO:4 Compare different automotive lighting systems.
				CO:5 Examine different automotive electrical system and auxiliaries.
				CO:6 Illustratedifferent communication protocols and functional safety in automobiles.
22	II	MAT117	Automotive Testing and Certification	CO:1 Describe requirementsof automotive component/systems as per the standards.
				CO:2 Demonstrate vehicle and engine test procedures as per standards.
				CO:3 Explain testing of automotive components as per standards.
				CO:4 Describe xEV test requirements and procedure as per standards.
23	II	MAT118	Engine Design and Development	CO:1 Explain the various combustion processes in automotive engines.
				CO:2 Design and develop the engine using software virtually.

				CO:3 Differentiate the need of cooling systems in automotive engine design.
				CO:4 Demonstrate latest trends in designing and development of automotive engines.
24	II	MAT119	Automotive Materials and Manufacturing	CO:1 Describe the types of ferrous & non-ferrous alloys.
				CO:2 Analyze the mechanical surface treatment and coatings done on materials.
				CO:3 Describe and syntheses the need for modern materials and its alloys.
				CO:4 Discuss the materials used to manufacture engine and describe the manufacturing processes.
				CO:5 Illustrate materials used in Electric Vehicles.
25	II	MAT120	Automotive Diagnostics	CO:1 Describe the working principle of networking protocols and ECU.
				CO:2 Interpret different fault codes and diagnostics techniques used of ECU.
				CO:3 Identify the use of different diagnostics tools.
				CO:4 Explain the approach techniques used to resolve the issues flagged
				CO:5 Illustrate OBD, its tools and techniques.
26	II	MAT121	Automotive Intelligence	CO:1 Identify the relation between system and signals.
				CO:2 Apply the knowledge of intelligence to automotive domain.
				CO:3 Explore various tools in the field of intelligence awareness.
				CO:4 Apply neural network for automotive application.
				CO:5 Analyze the different ways to extract and retrieve information from automobile.
27	II	MAT122	Autonomous & Connected Vehicles	CO:1 Describe the types of Autonomous Vehicles.
				CO:2 Discuss Safety frameworks-ISO 26262.
				CO:3 Analyze and syntheses Perception and Planning.
				CO:4 Discuss computer visions.
				CO:5 Discuss and describe recent trends in Autonomous Vehicles.
28	II	MAT123	Hydrogen and Fuel Cell	CO:1 Explain various physio-chemical properties of hydrogen.

				CO:2 Describe various production techniques and storage methods of hydrogen.
				CO:3 Explain the concept- methods and various features related to usage of hydrogen in SI Engines.
				CO:4 Explain the concept- methods and various features related to usage of hydrogen in CI Engines.
				CO:5 Illustrate the technical features of fuel cells for automotive applications.
				Outline the design concepts of hydrogen fuel cell systems for road vehicles.
29	III	MAE3010	Industry Internship	CO:1 Acquire sufficient knowledge in the respective Industry.
				CO:2 Explain the various departments in the industry.
				CO:3 Identify problems in the process in Industry.
				CO:4 Suggest some remedies for the identified problems
30	III	MAE3030	Dissertation Phase-I	CO:1 Explain the contributions of various researchers in the field of design engg. after carrying out literature survey from reputed journals
				CO:2 Recognize the gap in the research and define a problem statement
				CO:3 Explain significance and applicability of problem statement
				CO:4 Summarize and present technical data in report format
31	III	MAE3040	Dissertation Phase-II	CO:1 Outline the work plan for problem statement
				CO:2 Identify the proper modeling and analysis tool
				CO3: Reproduce the preliminary results of problem statement
				CO:4 Summarize and present technical data in report format
32	III	MOE2010	Artificial Intelligence - Machine Learning	CO:1 Describe central machine learning methods and techniques and how they relate to artificial intelligence
				CO:2 Differentiate between supervised and unsupervised learning techniques
				CO:3 Apply the ML algorithms to a real-world problem,
				CO:4 Optimize the models learned and report on the expected accuracy

				that can be achieved by applying the models.
				CO:5 Evaluate a given problem and apply appropriate machine learning technique.
33	III	MOE2020	Creative Thinking: Techniques and Tools	CO:1 Comprehend importance in tackling global challenges as well as in everyday problem solving scenarios
				CO:2 Apply different brainstorming techniques in group activities
				CO:3 Be proficient in the application of the 6 thinking hats tool in different life scenarios
				CO:4 Develop a systematic approach to idea generation through the use of morphological analysis
				CO:5 Innovate on an existing product, service or situation applying the SCAMPER method
				CO:6 Get confident with the theory of inventive problem solving, called TRIZ
				CO:7 Select and apply the appropriate technique based on the opportunity to seize or the problem to tackle.
34	III	MOE2030	MOOC Course	CO:1 Identify the real applications and practices of courses studied, at industry level
				CO:2 Recognize various modelling, analysis and validation techniques adopted at industries.
				CO:3 Demonstrate the issues at design, manufacturing and assembly levels.
				CO:4 Summarize and present technical data in report format.
35	III	MOE2040	Condition Monitoring and Signal Processing	CO:1 Identify the maintenance scheme, their scope and limitations – apply the maintenance strategies to various problems in the industrial sectors.
				CO:2 Analyze for machinery condition monitoring and explain how this compliments monitoring the condition.
				CO:3 Develop an appreciation for the need of modern technological approach for plant maintenance to reduce the maintenance expenditure.
				CO:4 Emphasizes on case studies that require gathering information using the modern testing equipment

				and processing it to identify the malfunction in that system.
				CO:5 Identify vibration measurement, lubrication oil analysis.
36	III	MOE2050	Aircraft Conceptual Design	CO:1 Understand the design process of aircraft and decide the aircraft configuration.
				CO:2 Choose type of power plant as per flight regime.
				CO:3 Decide the fuselage layout as per type of aircraft.
				CO:4 Design the wing for type of aircraft and its wing loading.
				CO:5 Accurately evaluate lift, drag and mass for design synthesis process.
				CO:6 Examine the influence of various design requirements on the configuration of an aircraft to derive an optimized design.
37	IV	MAE4010	Dissertation Phase-III	CO:1 Explain the issues related to method adopted in solving the problem
				CO:2 Select proper technique in solving the problem
				CO3: Compare the results with available literature
38	IV	MAE4020	Dissertation Viva-voce	CO:1 Design new methodology to address the problem
				CO:2 Justify the results obtained from new methodology
				CO:3 Write technical report and defend work.

Civil Engineering

- **Department Name :- Civil Engineering**
- **UG Program Name :- Civil Engineering**
- **Vision: -**To be an outstanding department devoted to provide high end research and technical education in Civil engineering which will produce socially aware professionals to provide solutions to global community.

- **Mission**: -

1. To design curriculum based on changing needs of stakeholders & provide excellence in delivery & assessment to ensure holistic development of civil engineering students.
2. To enhance research & consultancy resulting in solving problems related to civil engineering infrastructure as well as society at large.
3. To mentor students in pursuit of higher education, entrepreneurship and global professionalism.

Sr. No.	Program Outcomes
1.	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.

Sr. No.	Program Specific Outcomes
1.	Enhance employability and/or entrepreneur skills through in-house and onsite training.
2.	Provide solutions/procedures to societal and rural development problems through research and innovative practices.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	III	CE2012	Building Planning and Design	1. Choose appropriate building materials for building construction applications. 2. Prepare a functional design of components for residential buildings. 3. Plan and design residential buildings. 4. Choose the appropriate type of plumbing, electrification system and building finishes for residential buildings.
2.	III	CE2032	Engineering Mechanics	1. Classify various forces and their effects, to analyze real life problems. 2. Analyze engineering problems applying conditions of equilibrium 3. Apply fundamental concepts of Kinematics and Kinetics to the analysis of practical problems 4. Determine Centroid & Moment of Inertia of the geometrical plane laminae
3.	III	CE2052	Strength of Material	1. Analyze structural members for various types of stresses and strains. 2. Determine shear and bending stresses for determinate beams. 3. Construct shear force and bending moment diagrams for determinate beams.
4.	III	SH2052	Engineering Mathematics III	1. Solve problems on linear differential equations with constant coefficients. 2. Apply linear differential equations (LDP) to deflection of beams and Columns. 3. Solve problems on linear partial differential equations with constant coefficients. 4. Determine Fourier series of given function. 5. Compute Karl Pearson's coefficient of correlation and determine regression lines. 6. Use probability distributions to solve the engineering problems
5.	III	CE2072	Surveying	1. Calculate reduced levels and prepare contour maps. 2. Calculate the angular and linear measurements by using tachometry and trigonometry 3. Design and Set out the curve on field. 4. Illustrate the principles of advanced surveying techniques.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
6.	III	SH2172	Environmental Science (Mandatory Course)	1. Study the importance and sensitivity of environment. 2. Interpret the over exploitation of natural resources and follow the environmental ethics. 3. Explain the methods to protect environment and prevent environmental pollution. 4. Apply their knowledge and skills to solve their environment related problems.
7.	III	CE2092	Building Planning and Design lab	1. Explain properties and uses of different building materials. 2. Draw various building components using AutoCAD software. 3. Prepare submission drawing of residential building using AutoCAD. 4. Prepare working drawings of residential building using AutoCAD. 5. Draw line plan of various public buildings.
8.	III	CE2112	Surveying Lab	1. Calculate reduced levels and prepare contour maps by using theodolite. 2. Design and Set out the curve on field. 3. Perform setting out for various construction works. 4. Apply tachometry and trigonometry concepts to calculate distances & elevations. 5. Prepare the layout map by using the Total Station.
9.	III	CE2132	Strength of Material lab	1. Demonstrate behavior of material under axial shear and bending forces. 2. Identify various types of stresses in various structural elements. 3. Determine various strengths of different construction materials
10.	III	CE2172	Engineering Mechanics Lab	1. Verify law of polygon of forces, law of triangle of forces and principle of moment. 2. Compare coefficient of friction of various surfaces in contact. 3. Correlate theoretical and practical results of support reactions and Centroid of plane lamina. 4. Analyze a simple truss.
11.	III	SH2602	Environment Project	1. Develop as an individual and in group leadership quality.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				2. Identify and analyse social problems in Civil Engineering. 3. Develop presentation skill through oral and report writing. 4. Acquire theoretical knowledge regarding various problems in Civil Engineering.
12.	III	SH****	Open Elective –II Choice Based Soft Skill Program-I	
13.	III & IV	SH254	Personal Effectiveness and Body Language (Lab Oriented)	1. Develop skills to build self-esteem and positive attitude. 2. Discover ways to overcome procrastination. 3. Demonstrate responsiveness towards stress and health issues. 4. Interpret the non-verbal behaviour of a person.
14.	III & IV	SH255	Interpersonal Skills Lab	1. Exhibit interpersonal communication skills. 2. Demonstrate decision-making skills. 3. Apply conflict resolution styles appropriate in different situations. 4. Demonstrate leadership skills.
15.	III & IV	SH256	Leadership and Public Speaking Lab	1. Exhibit the ability to work effectively in team. 2. Describe the traits of a leadership through real life examples. 3. Plan the speech as per the audience and context requirements. 4. Analyze public speeches.
16.	III & IV	SH257	Corporate Competency Lab	1. Demonstrate professional etiquette and ethics. 2. Apply various presentation tools. 3. Perform confidently in screenings of campus placement drives. 4. Demonstrate video and tele-conferencing skills.
17.	III & IV	SH258	Introduction to English Literature	1. Explain literary concepts and the underlying aesthetics of English literature. 2. Demonstrate reading skills. 3. Interpret different types of text. 4. Make use of newly learnt words in various contexts
18.	IV	CE2022	Engineering Geology	1. Identify common Earth materials and interpret their composition, origin, and uses. 2. Recognize and interpret geological structures, and be able to apply their knowledge and skills to interpret earth processes.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				3. Classify hydro geological properties of various rocks. 4. Describe the processes operating at and beneath the Earth's surface. 5. Compare the suitable site s for construction of dam, tunnel in different geological formation and geological structures. 6. Interpret spatial relationships of geological and geographical features.
19.	IV	CE2042	Concrete Technology	1. explain properties of various materials used in the manufacture of different kinds of concretes and role played by them in developing strong, durable concretes 2. describe various properties of concretes in fresh and hardened state 3. design concrete mixes of given grade using mix design procedures recommended by IS Code and ASTM, ACI code. D 4. escribe the properties of special types of concretes based on their material composition and method of manufacture. 5. lustrate various mechanisms causing the deterioration of concrete /elements of concrete structures
20.	IV	CE2062	Fluid Mechanics	1. Analyze different physical properties of fluid. 2. Calculate varies forces acting on submerged and floating bodies. 3. Discriminate fluid kinematics and fluid dynamics. 4. Illustrate flow through pipe and flow through open channel. 5. Prepare dimensional analysis using different theories and models. 6. Explain terms used in hydraulic pumps.
21.	IV	CE2082	Mechanics of Structures	1. Analysis of circular shafts subjected to torsion. 2. Compute slopes and deflections at various locations for determinate beams. 3. Design axially loaded columns. 4. Construct ILD for determinate beams and 2D trusses. 5. Determine strain energy stored in the material due to gradual, sudden and impact loads. (Note – combine co)
22.	IV	CE2102	Human Values and Professional Ethics	1. Practice the moral value in engineering profession.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				2. Resolve the moral issues in the profession. 3. Justify the moral judgment concerning the profession.
23.	IV	CE2122	Applications of Programming Language in Civil Engineering	1. Formulate simple programs for arithmetic, logical and loops problems(in C language) 2. Formulate simple programs for arithmetic, logical and loops problems(Microsoft excel). 3. Test and execute the programs and correct syntax and logical errors.
24.	IV	CE2142	Engineering Geology Lab	1. Recognize and describe common geological formations related to civil engineering. 2. Identify the different Rock types. 3. Implement various methods for water conservation techniques. 4. Use of electrical resistivity method for determining depth of bedrock or groundwater.
25.	IV	CE2162	Fluid mechanics Lab	1. Determine metacentric height, type of flow, major losses, minor losses, coefficient of discharge, coefficient of contraction, and coefficient of velocity of liquid. 2. Design most economical open channel section. 3. Measure velocity of flow using wind tunnel.
26.	IV	CE2182	Concrete Technology Lab	1. Explain standard procedures for testing properties of various ingredients of concrete and concrete mixes/specimens 2. Perform tests on ingredients of concrete and on fresh and hardened concrete to determine their properties using standard procedures 3. Design the concrete mix for a given grade of concrete using guidelines of IS code 4. Prepare the test set up for conducting various tests on concrete mixes / specimens 5. Evaluate the quality of concrete specimens / elements using NDT equipments
27.	IV	CE2202	Comprehensive Exam II	
28.	IV	CE2222	Internship	1. Make aware the responsibility of student on work site.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				2. Seek knowledge , information and details at site from live situations at field. 3. Co relates practical and theoretical information and understand the concept of experienced learning.
29.	V	CE3012	Design of Steel Structures	1. Refer and use design codes and hand book for design of steel structural elements. 2. Analyse steel structural members. 3. Design steel structural members.
30.	V	CE3032	Geotechnical Engineering	1. Classify types of soil using different index properties of soil. 2. Calculate permeability of various types of soil using different methods. 3. Analyse compressibility phenomenon of soil using Laboratory and field considerations. 4. Determine settlement, shear strength and bearing capacity of soil.
31.	V	CE3052	Irrigation and Hydraulic Structures	1. Discuss aspects of hydrology and ground water flow. 2. Estimate the parameters for water requirements of crop. 3. Explain importance of ground water resources. 4. Design earthen/ gravity dam
32.	V	CE3072	Environmental Engineering	1. Analyze water and wastewater for various parameters. 2. Identify and value the effect of pollutants on the environment: atmosphere, water and soil. 3. Prepare layout of water and wastewater treatment process. 4. Design water and wastewater Treatment Plant. 5. Interpret the impact of humans on environment.
33.	V	CE3092	Transportation Engineering	1. Design of geometric components of highway and railway. 2. Determine traffic volume for design of road infrastructure 3. Perform pavement design and different tests on highway materials 4. Design rail transportation system
34.	V	CE3112	Geotechnical Engineering Laboratory	1. Determine index and engineering properties of soil. 2. Classify soil based on its index properties. 3. Analyze field conditions through Laboratory tests
35.	V	CE3132	Environmental Engineering Laboratory	1. Analyse water and wastewater characteristics. 2. Prepare a layout of water and wastewater treatment plant. 3. Design of water and wastewater treatment plant.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
36.	V	CE3152	Transportation Engineering Laboratory	1. Characterize the pavement materials 2. Perform quality control tests on pavement materials 3. Design bituminous mixes for flexible pavement 4. Design concrete mix for rigid pavement 5. Calculate thickness of different layers of pavement
37.	V	SH3032	Aptitude Training-I	1. Develop a thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning problems. 2. Understand usage of basic aptitude terms of percentages, averages, ratios and applications of business aptitude terms of profits and interests 3. Develop a bridge in analogies, series and visualizing directions. 4. Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams.
38.	V	CE 3172	Comprehensive Exam III	Nil
39.	V	SH301	Constitution of India	1. Create awareness about law depiction and importance of Constitution 2. Define Fundamental Rights and Fundamental Duties of the Indian Citizen to instill morality, social values, honesty, dignity of life and their social Responsibilities. 3. Create Awareness of their Surroundings, Society, Social problems and their suitable solutions while keeping rights and duties of the citizen keeping in mind. 4. Recognize distribution of powers and functions of Local Self Government. 5. Comprehend the National Emergency, Financial Emergency and their impact on Economy of the country.
40.	V	CE3192	Structural Analysis	1. Analyse pin jointed truss for deflection by strain energy method. 2. Evaluate horizontal thrust, radial shear and normal of arches. 3. Analyse beam by plastic analysis method. 4. Determine bending stresses in beams due to unsymmetrical bending. 5. Analyse building frames using approximate methods of analysis. 6. Predict failure of structure by using various theories of failure.
41.	V	CE3212	Composite Materials	1. Explain the methods of manufacturing, properties and applications of various composites materials.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				2. Determine stresses and strains in composites. 3. Apply failure criteria and critically evaluate the results. 4. Explain mechanical behavior of composites due to variation in temperature and moisture.
42.	V	CE3232	Construction Safety and Quality Management	1. Apply various quality improvement techniques. 2. Diagnose problems in the quality improvement process 3. Suggest safety precautions to be taken during the execution of various construction works 4. Analyze possible hazards and accidents in construction projects 5. Interpret various legal aspects of safety in construction.
43.	V	CE3252	Advanced Construction Techniques	1. Develop method statements for construction techniques. 2. Select construction technique for activity. 3. Justify application of construction technique for particular task. 4. Justify construction safety needs and management on projects.
44.	V	CE3272	Instrumental Monitoring of Environment and Modeling	1. Analyze the principles of volumetric and instrumental analytical methods in environmental monitoring 2. Evaluate statistical methods for evaluating and interpreting data of environmental interest 3. Describe various electrochemical methods 4. Summarize various material characterization techniques and its principles
45.	V	CE3292	Tunnel Docks and Harbors Engineering	1. Develop method statement for given construction activity, 2. Compare tunnel construction technologies 3. Decides safety and ventilation system for tunnels, 4. Suggest appropriate location for construction of docks and harbours 5. Select dredging method for particular operation.
46.	V	CE3312	Urban Transportation Systems	1. Categorize the transportation problems in urban area 2. Perform the transportation survey in urban area to predict the travel demand

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				3. Explain different urban transportation planning methods 4. Predict rout and schedule for mass transit system 5. Explain different methods of preparation of transportation plan
47.	VI	CE3022	Theory of Structures	1. Analyse indeterminate structures using force methods- Consistent deformation method and three moment equation. 2. Apply energy principles/theorems for analysis of indeterminate beams, truss, portal frames and two hinged parabolic arches. 3. Analyse indeterminate structures using displacement methods- Slope-deflection equation and moment distribution method. 4. Analyse indeterminate beam and portal frame using matrix methods of analysis- Stiffness and flexibility matrix method.
48.	VI	CE3042	Estimating and Costing	1. Apply standard requirements to prepare detailed estimate 2. Prepare detailed estimate of building, factory shed, road, canal and culvert. 3. Derive Rates for construction items, 4. Prepare tenders and contracts documents 5. Perform valuation of property.
49.	VI	CE3062	Design of Reinforced Concrete Structures	1. Analyze and design singly & doubly reinforced and flanged beams. 2. Analyze and design R.C.C. slab and R.C.C. staircase 3. Analyze and design R.C.C. columns, isolated pad footing and combined footing.
50.	VI	SH302	Biology for Engineers	1. Apply biological engineering principles, procedures needed to solve real-world problems 2. Demonstrate the functions of biological systems 3. Analyze biological phenomena with math and physics to gain important insights 4. Explain working of different biomedical instruments 5. Select the sensors for given biological applications 6. Explain relevant aspect of movement control process.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
51.	VI	CE3082	Estimating & Costing Laboratory	**1.** Explain mode of measurement and current market rates of civil engineering materials and labours. **2.** Prepare detailed estimate of different structures like building, road, canal, culvert and factory shed etc. **3.** Prepare bar bending schedule of different RCC items.
52.	VI	CE3102	Design of Steel Structures Laboratory	1. Analyze and design steel industrial shed using STAAD-Pro software. 2. Interpret the results obtained from the software. 3. Prepare structural drawing of steel industrial shed.
53.	VI	CE3122	Comprehensive Exam IV	Nil
54.	VI	SH3042	Aptitude Training-II	1. Develop a thorough conceptual understanding and develop a logical approach towardssolving Aptitude and Reasoning Problems 2. Understand usage of aptitude terms of speed, time and distance and permutations, probabilities and applications. 3. Understand blood relations and ways of seating arrangements along with various geometrical figures 4. Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams.
55.	VI	CE3142	Mini Project	1. Develop as an individual and in group leadership quality. 2. Identify and analyse social problems in Civil Engineering. 3. Develop presentation skill through oral and report writing. 4. Acquire theoretical knowledge regarding various problems in Civil Engineering.
56.	VI	CE3162	Design of Industrial Structures	1. Design industrial buildings, beam columns 2. Design open web sections 3. Design steel towers, water tanks, truss bridge
57.	VI	CE3182	Repair and Rehabilitation of Structures	1. Diagnose the causes of distress a deterioration of concrete structure 2. Describe the procedures of various repa techniques or methods 3. Suggest appropriate materials and techniqu for repair and strengthening structures/elements 4. Prepare a report on condition assessment of buildings based on observations
58.	VI	CE3202	Construction Economics and Finance	1. Identify appropriate economic alternatives.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				2. Calculate depreciation and taxes for economic analysis. 3. Select appropriate alternative related to equipment. 4. Discuss methods of estimate. 5. Discuss basics of financial management.
59.	VI	CE3222	Disaster Preparedness and planning	1. Analyze effects of natural and manmade disasters. 2. Demonstrate disaster management program. 3. Analyze vulnerable conditions and risk assessment. 4. Construct layout for sanitary landfill site and composting site 5. Describe stakeholder's role in disaster response.
60.	VI	CE3242	Air Quality Monitoring and Modelling	1. Illustrate structure of the atmosphere Air Pollution, Scales of air pollution 2. Interpret impact of air pollution on natural and artificial elements. 3. Analysis of air quality parameters by using air quality monitoring methods 4. Design Stack height for pollution control.
61.	VI	CE3262	Railway and Airport Engineering	1. Design of geometric component of rail transport system. 2. Analyse need of modern rail system. 3. Design of runway and taxiway 4. Perform airport planning 5. Create airport layout
62.	VI	CE3302	Design of Bridges	1. Understand the load distribution and IRC standards. 2. Design the slab and T beam bridges. 3. Design Box culvert, pipe culvert 4. Use bearings, hinges and expansion joints
63.	VI	CE3322	Design of Earthquake Resistant Structures.	1. Evaluate responses for single degree of freedom system for free and force vibration by various methods. 2. Evaluate lateral loads developed due to earthquake force by equivalent static method 3. Predict causes of earthquake. 4. Design ductile detailing of RCC structural elements. 5. Apply principles of planning, structural systems for seismic resistant to structures.
64.	VI	CE3342	Advanced Construction Equipment	1. Select equipment base on economic analysis. 2. Justify equipment selection for particular activity. 3. Develop method statement for construction activity using equipments. 4. Draw optimum Layout of construction Plants.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
65.	VI	CE3382	Environment Management System	1. Apply an environmental policy for an organization. 2. Develop environmental objectives and monitor their implementation. 3. Perform a life cycle assessment for a selected product or service. 4. Apply standard environmental, health and safety auditing principles and practices to environmental management systems.
66.	VI	CE3402	Geographical Information System	1. Apply GIS tool for solving civil engineering industry problem 2. Perform infrastructural planning 3. Analyse spatial data and query analysis 4. Develop base and thematic maps 5. Develop projects and device solution for the area.
67.	VI	CE3422	Foundation Engineering	1. Investigate soil using different soil exploration methods. 2. Compute stress distribution in soil using different theories. 3. Design shallow and deep foundation on different types of soil. 4. Analyze stability of slope using different slope stability analysis techniques. 5. Compute lateral earth pressure for different conditions of soil.
68.	VI	CE3442	Intelligent Transport System	1. Categorize the transportation problems in urban area 2. Perform the transportation survey in urban area 3. Calculate the travel demand in future 4. Explain different urban transportation planning and transportation plan preparation methods 5. Predict rout and schedule for mass transit system
69.	VII	CE 4632	Construction Management	1. Apply principles of management. 2. Develop and analyze the network diagram for civil engineering projects. 3. Apply principles of work study to design site layout. 4. Apply various techniques for inventory control.
70.	VII	CE 4032	Construction Equipment and Methods	1. Plan equipment utilization for earthwork operation. 2. Perform economic analysis of equipment. 3. Select earthwork equipment based on production and site requirements. 4. Decide plant capacity required for a project. 5. Select Equipment fleet for Project.
71.	VII	CE4092	Advanced Structural Analysis	1. Construct ILD for indeterminate beams. 2. Analyze and construct BMD, TMD for beams curves in plan. 3. Analyze beam on elastic foundation under various loads.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				4. Analyze beam-column with different support and loading conditions. 5. Determine forces in space truss members. 6. Evaluate various forces developed in cables and stiffening girder.
72.	VII	CE4112	Finite Element Analysis	1. Apply variational and direct approach method for 1D, 2D problems. 2. Develop element stiffness matrix for 1D, 2D & 3D problem. 3. Describe Convergence and compatibility requirements. 4. Generate relationship between natural and cartesian coordinate system. 5. Formulate element stiffness matrix for axisymmetric elements.
73.	VII	CE4132	Project Management	1. Analyze impact of time, cost and scope on construction projects. 2. Develop pre-feasibility report for construction project. 3. Plan the project using various techniques. 4. Develop project close out checklist for given project. 5. Apply techniques for manpower planning.
74.	VII	CE4152	Rock Mechanics	1. Describe the theory and analysis of in-situ induced stresses in a rock mass and structurally controlled failure. 2. Apply the principles of rock mechanics and excavation design to develop excavation proposals for given geologic environments. 3. Analyze the rock and soil slope stability and rockfall hazards. 4. Explain the principles and techniques of reinforcement design for the primary failure modes in underground rock excavations
75.	VII	CE4172	Industrial Waste Management	1. Apply various techniques of wastewater volume and strength reduction 2. Analyze characteristics of Industrial wastewater. 3. Suggest different wastewater treatment options for industrial wastewater. 4. Design Effluent Treatment Plant for Industrial wastewater treatment.
76.	VII	CE4192	Pavement Analysis and Design	1. Suggest suitable materials for different types of pavements. 2. Analyse the pavement components with respect to their material composition. 3. Estimate the stresses induced due to wheel load and temperature. 4. Design the pavement, flexible or rigid, for the conditions prevailing at site. 5. Understand the variation in specification for pavement materials used in other countries.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
77.	VII	CE4212	Advanced Structural Analysis Lab	1. Analyze beams curved in plan, multistoried buildings, space frames using classical methods and software. 2. Compare results of results of classical methods of structural analysis using software results. 3. Critique on the analysis results obtained by software.
78.	VII	CE4232	Finite Element Analysis Lab	1. Illustrate terms used in Finite Element Method 2. Analyse 1D & 2D problems. 3. Develop solution of 2D & 3D problems using Finite Element software
79.	VII	CE4652	Project Management Laboratory	1. Develop a project charter for a construction project. 2. Analyze feasibility of project. 3. Determine optimum time and optimum cost of project through network compression. 4. Develop project in Microsoft project tool. 5. Plan resources required for execution of the project.
80.	VII	CE4272	Rock Mechanics Laboratory	1. Determine the physical and mechanical properties of rock sample. 2. Identify various types of rock based on observations and laboratory testing. 3. Prepare the site investigation report.
81.	VII	CE4672	Industrial Waste Management Laboratory	1. Analyse Industrial wastewater characteristics. 2. Prepare a layout of wastewater treatment plants for Industrial wastewater. 3. Design of Effluent Treatment Plant for Industrial wastewater. 4. Prepare Field visit Report of ETP of Industry.
82.	VII	CE4312	Pavement analysis and Design Laboratory	1. Categorize bituminous materials. 2. Analyse quality control of pavement materials 3. Design bituminous mixes for flexible pavement. 4. Design concrete mix for rigid pavement
83.	VII	CE4392	Advanced Structural Design	1. Analyze and design RC structures and their components like building frames, flat slab, retaining walls, water tanks and piles using relevant codes and applying codal provisions. 2. Analyze the slabs of irregular shapes by yield line theory and design rectangular and circular slabs for yield moments. 3. Sketching the detailing of reinforcement in structural components of building frames, flat slab, retaining walls, water tanks and

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				piles.
84.	VII	CE4412	Pre-Stressed Concrete Structures	1. Explain the concept and importance of pre-stressing. 2. Analyse the pre-stressed concrete sections. 3. Design the pre-stressed concrete sections for flexure and shear. 4. Design an end block for pre-stressed members. 5. Design the pre-stressed concrete beams.
85.	VII	CE4432	Matrix Methods of Structural Analysis	1. Perform the structural analysis of determinate and indeterminate structures using classical methods, force and displacement methods. 2. Analyze the structures by using the stiffness & flexibility method. 3. Solve multiple degree of freedom two-dimensional problems involving trusses & beams.
86.	VII	CE4452	Construction Resource Planning and Management	1. Codify materials for construction resource planning and management. 2. Select vendor for material purchase in construction resource planning. 3. Manage inventory for construction resource planning and management. 4. Describe employee development and welfare. 5. Design performance appraisal matrix construction resource planning and management,
87.	VII	CE4472	Total Quality Management	1. To identify basic requirements for applying TQM in construction. 2. To prepare the TQM framework. 3. To apply seven QC tools of quality assurance. 4. To use six sigma techniques to improve quality.
88.	VII	CE4492	Air Pollution and Control	1. Examine structure of the atmosphere air pollution, scales of air pollution. 2. Interpret on sources of air pollution natural and artificial, air pollution Episodes 3. Analyse effect of different air pollutants on man, animals and plants. 4. Design Stack height and explain meteorology, transport and control mechanism. 5. Evaluate effects of noise pollution.
89.	VII	CE4512	Fundamentals of Urban and Regional Planning	1. To apply international planning and design theories in a development design. 2. To measure the impact of manmade activities on urbanization. 3. To evaluate the impact of urban development plans in regards to sustainable urban development and urban quality.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				4. To use tools and techniques of region planning.
90.	VII	CE4532	Solid and Hazardous Waste management	1. Determine solid waste properties and quantity for municipal and hazardous waste. 2. Illustrate health effects by municipal, hazardous waste. 3. Design Physicochemical and biological treatment and landfill site for solid waste. 4. Design of landfill design
91.	VII	CE4552	Photogrammetric Surveying	1. Apply advanced surveying methodologies to conduct topographical survey. 2. Analyse and correct the errors from the topographical survey maps. 3. Illustrate the principles of advanced surveying techniques.
92.	VII	CE4572	Geo-informatics for Engineering	1. Apply GIS tool for solving civil engineering industry problem 2. Develop infrastructural planning 3. Collect data and query analysis 4. Develop base and thematic maps. 5. Develop projects and device solution for the area.
93.	VII	CE4592	Docks, Harbors and Airport Engineering	1. Analyze theoretical and practical aspects related to docks, harbour and airport management. 2. Apply diverse knowledge of Docks, Harbour and Airport engineering practices applied to real life problems. 3. Categorize port components 4. Design airport components
94.	VII	CE4052	Design of Concrete Structures Laboratory	1. Estimate primary and combination design loads on building consulting appropriate standards and handbooks 2. Design the component parts of the building manually 3. Model the same building using any standard software 4. Design the building. 5. Demonstrate effective team membership/leadership through a group project
95.	VIII	CE4072	Employment Enhancement Skills	1. Develop technical competence in a Soft skill in the Civil Engineering field, 2. Apply the techniques and soft skills for Civil Engineering practice. 3. Develop oral and written presentation skills for soft skill project. 4. Design and interpret data by soft skill Civil Engineering projects.
96.	VIII	IP4022	Internship & Project	**1.** Internship After the successful completion of the IIP- II the student should be able to

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				1. Examine the functioning of the company on the terms of inputs, transformation process and the outputs (products and services) 2. Develop an attitude to adjust with the company culture, work norms, code of conduct. 3. Recognize and follow the safety norms, Code of conduct. 4. Demonstrate the ability to observe, analyse and document the details as per the industry practices. 5. Interpret the processes, systems and procedures and to relate to the theoretical concepts- studies. 6. Develop the leadership abilities, communication. 7. Demonstrate project management and finance sense **2.** Project After the successful completion of the project, the student should be able to; 1. Identify the project/problem in the domain of a program relevant for the company. 2. Compile the information to the pertaining to the problem identified. 3. Analyse the information using the statistical tools/ techniques. 4. develop the feasible solution for given problem. 5. Analyse the impact of the project on the performance of company/department.
97.	VIII	OE438	Finance for Engineers (Online Course)	6. Discuss the fundamental aspects of accounting and finance. 7. Apply rules of accounting while recording transactions. 8. Prepare financial statements and analyze financial position of the firm by applying various techniques. 9. Describe the various long term sources of finance available for the business organization.
98.	VIII	OE436	Engineering Management & Economics (Online Course)	1. Develop administrative, organizational and planning skills to execute engineering project. 2. Develop bar chart/mile stone chart for the project. 3. Analyze profit/cost data and carry out economic analysis to take optimal decision. 4. Calculate depreciation as per various methods.
99.	VIII	RE4042	Research Project	1. Investigate the technical literature. 2. Recognize and evaluate theories, practices, and/or research on a chosen topic by conducting a thorough literature review and submitting a written

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				integrative, critical summary of the current literature. 3. Design a research problem and develop a methodology. 4. Develop and implement an advanced original research or creative project. 5. Develop the ability to explain the conceptual viability of the project and describe the major components involved. 6. Develop the ability to explain how the project will impact the relevant body of work. 7. Develop advanced discipline-relevant skills and competencies. 8. Construct an accurate record of research performed. 9. Write a research report and paper.
100.	VIII	OE438	Finance for Engineers (Online Course)	1. Discuss the fundamental aspects of accounting and finance. 2. Apply rules of accounting while recording transactions. 3. Prepare financial statements and analyze financial position of the firm by applying various techniques. 4. Describe the various long term sources of finance available for the business organization.
101.	VIII	OE436	Engineering Management & Economics (Online Course)	1. Develop administrative, organizational and planning skills to execute engineering project. 2. Develop bar chart/mile stone chart for the project. 3. Analyze profit/cost data and carry out economic analysis to take optimal decision. 4. Calculate depreciation as per various methods.
102.	VIII	ED4102	Project Management	1. Prepare business Plan for selected business. 2. Make risk analysis& market analysis of selected project. 3. Make risk analysis& market analysis of selected project 4. Make financial appraisal of selected project.
103.	VIII	ED4082	Entrepreneurship Development Project	1. Apply knowledge of engineering, economics, marketing and finance for preparation of project report. 2. Make commercial, technical and financial appraisal of project.
104.	VIII	ED4062	Entrepreneurship Development Program (EDP)	1. Apply knowledge of engineering, economics, marketing and finance for formulation of business plan, starting & managing new business.
105.	VIII	ED4042	Commercial Aspects of the Project	1. Interpret basic Financial Terminologies. 2. Prepare &analyze financial statements. 3. Prepare financial Plan for venture.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
				4. Apply basic principles of marketing for various products. 5. Prepare market survey. 6. Apply knowledge of marketing management for selected business.

- **Department Name :- Department of Civil Engineering**
- **PG Program Name: M Tech Structural Engineering**
- **Vision and Mission :-**

Department Vision:

To be an outstanding department devoted to provide high end research, technical education in Civil engineering which will produce socially aware professionals to provide solutions to global community.

Department Mission:

- To design curriculum based on changing needs of stakeholders & provide excellence in delivery & assessment to ensure holistic development of civil engineering students.
- To enhance research & consultancy resulting in solving problems related to civil engineering infrastructure as well as society at large.
- To mentor students in pursuit of higher education, entrepreneurship and global professionalism.

Sr. No.	Program Outcomes
1.	PO1: An ability to independently carry out research /investigation and development work to solve practical problems.
2.	PO2: An ability to write and present a substantial technical report/document.
3.	PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

Sr. No.	Program Specific Outcomes
1.	PSO 1:An ability to design civil engineering structures and execute the projects.
2.	PSO2 :An ability to use modern tools and techniques, skills, instrumentation and software packages necessary to predict and solve complex engineering problems.
3.	PSO3: An ability to perform efficiently with others as part of collaborative and/or multidisciplinary team with ethics.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	I	**CES1012**	**Advanced structural analysis**	1. Construct of ILD for reactions, S.F. and B.M. for indeterminate structures. 2. Draw SFD, BMD and TMD for beams curved in plan for various loading and support condition. 3. Analyze the beam-columns. 4. Analyze the skeleton **structures** by using matrix method.

				5. Solve civil engineering boundary value problems.
2.	I	**CES1022**	**Advanced solid mechanics**	1. Analyze bodies for stresses and strains. 2. Analyze prismatic bars and tubes subjected to torsion. 3. Analyze beams and thick cylinders for elasto-plastic loading.
3.	I	**CES1032**	**Structural Dynamics & Earthquake Engineering**	1. Analyze single and multi-degree freedom systems by fundamental theory and equations of motion. 2. Analyze single and multi-degree freedom systems by numerical methods. 3. Apply principles of planning, structural systems for seismic resistant to structures. 4. Determine causes of earthquake and its effect on human. 5. Evaluate lateral loads developed on multi-storied structures by the Response Spectrum Analysis Method and Static Equivalent Method.
4.	**I**	**CES1042**	**Structural Design Lab – I**	1.Analyze and design of the steel structures such as truss, Towers, Steel Building Frame and Hoarding Board etc. using standard software packages. 2.Interpret the results of analysis and design obtained from the software. 3. Prepare drawings of detailing of structural elements.
5.	I	**CES1052**	**Advanced Concrete Technology Lab**	1. Perform quality control tests on various ingredient of concrete and special concrete. 2. Design ordinary and special concretes using existing and new methods of mix design. 3. Evaluate quality of concrete using NDT. 4. Recommend appropriate methods / techniques for repair and strengthening works.
6.	I	**CES1062**	**Mini Project I**	1. Identify research problem. 2. Prepare and present statement of Purpose. 3. Perform analysis work. 4. Communicate with outside agencies. 5. Write report and Present the work carried out. 6. Develop self-learning ability
7.	I	**CES1072**	**Advanced Design of Steel Structures (PE I)**	1. Design steel structures and frames by varying methods. 2. Design various connectivity of structure as per code provisions.
8.	I	**CES1092**	**Advanced concrete technology**	1. Illustrate the micro-structural aspects associated with concrete/concrete ingredients and their effect on concrete quality, strength and durability properties. 2. Design special concretes using existing

				and new methods of mix design. 3. Explain various types of special concretes, their properties and methods of manufacturing and placing. 4. Describe various special processes and new techniques involved in various concreting jobs. 5. Analyze qualities of fresh and hardened concrete / concrete elements using appropriate destructive or non-destructive testing methods for evaluating quality. 6. Identify and discuss various mechanisms affecting durability of concrete / concrete structures /elements
9.	I	**SHP517**	**Numerical Methods for Structural Engineers**	1. Estimate the error. 2. Apply the relevant numerical method for interpolating the polynomial 3. Develop the equation to be fitted and fit the curve for given data 4. Estimate numerically the solution of given algebraic equation. 5. Use the relevant method for solving the simultaneous linear equations and compute the Eigen values. 6. Construct the fuzzy set for given linguistic variable and apply fuzzy logic.
10.	I	**SHP551**	**Technical Communication**	1. Acquire skills required for good oral and written communication. 2. Demonstrate improved writing and reading skills. 3. Ensure the good quality of oral and written communication.
11.	II	**CES2012**	**Finite Element Analysis in Structural Engineering**	1. Analyze structure using finite element method. 2. Solve continuum problems using finite element analysis. 3. Execute the Finite Element Program/ Software.
12.	II	**CES2022**	**Research Methodology& Intellectual Property Rights(IPR)**	1. Formulate a research problem. 2. Analyze research related information. 3. Prepare and present research proposal/paper by following research ethics. 4. Make effective use of computers and computing tools to search information, Analyze information and prepare report. 5. Describe nature and processes involved in development of intellectual property rights.
13.	II	**CES2032**	**Structural design LabII**	1. Analyze and design of the RCC structures such as building, retaining wall, flat slab and foundations using standard software packages.

				2. Interpret the results of analysis and design obtained from the software. 3. Prepare drawings of detailing of structural elements. 4.
14.	II	**CES2042**	**Structural Dynamics and Earthquake Engineering Lab**	1. Examine damping effect on beam model. 2. Perform testing of various models of structures for dynamic loading
15.	II	**CES2052**	**Mini project II**	1. Identify research problem 2. Prepare and present statement of Purpose 3. Perform analysis work. 4. Communicate with outside agencies. 5. Write report and Present the work carried out. 6. Develop self-learning ability
16.	II	**CES2062**	**Advanced Earthquake Engineering (PE-II)**	1. Design RCC structural elements for ductility requirements as per IS 13920 2916. 2. Apply new techniques for controlling the vibrations of the structures. 3. Evaluate natural frequency of continuous elements/systems. 4. Design elevated water tank for dynamic loading. 5. Apply IS code clauses masonry structures for improving resistance to earthquake forces.
17.	II	**CES2072**	**Theory and Applications of Cement Composites(PE-II)**	1. Formulate constitutive behavior of composite materials – Ferro cement, SIFCON and Fiber Reinforced Concrete - by understanding their strain- stress behavior. 2. Classify the materials as per orthotropic and anisotropic behavior. 3. Estimate strain constants using theories applicable to composite materials. Analyze and design structural elements made of cement composites
18.	II	**CES2082**	**Structural Optimization (PE-II)**	1. Use variational principle for optimization. 2. Apply optimization techniques to structural steel and concrete members. 3. Design using frequency constraint
19.	II	**CES2092**	**Design of Bridges and Flyovers (PE-III)**	1. Study various components and loadings on bridge. 2. Analyze and design of super-structure of various bridges and flyovers. 3. Analyze and design of sub-structure of various bridges and flyovers.
20.	II	**CES2102**	**Design of Pre-stress Concrete Structures(PE-III)**	1. Explain the concept of pre-stressing, behavior of the pre-stressed structures vis-à-vis that of the RCC structure. 2. Choose the decision with respect to the choice of pre-stressed section over RCC. 3. Describe the application of these techniques in civil engineering construction.

				4. Analyze the various pre-stressed components of the structures and design the same. 5. Design the various pre-stressed components of the structures and design the same.
21.	II	**CES2122**	**Design of Advanced Concrete Structures (PE-IV)**	1. Analyze the special R.C.C. structures. 2. Design and prepare detail structural drawings.
22.	II	**CES2132**	**Design of Industrial Structures(PE-IV**	1. Design the Steel Gantry Girders. 2. Design the Steel Portal, Gable Frames. 3. Design Steel Bunkers and Silos. 4. Design Chimneys and Water Tanks
23.	III	**CES3011**	**Industrial Training**	1. Identify training area. 2. Prepare on site work report of training. 3. Perform analysis work. 4. Communicate with agencies. 5. Generate report and Present the work carried out
24.	III	**CES3021**	**Certificate course**	1. Develop technical competence in skills of structural engineering field. 2. Apply the techniques for structural engineering practice. 3. Develop oral and written presentation skills for structural engineering projects. 4. Design and interpret data for structural engineering projects.
25.	III	**CES3031**	**Dissertation Phase-I**	1. Identify research problem from literature survey. 2. Prepare research design for identified problem. 3. Prepare synopsis report. 4. Present the work plan to be carried out.
26.	III	**CES3051**	**Dissertation Phase-II**	1. Prepare the set up for experimentation/ develop/ learn software. 2. Perform experimental/software analysis for validation of research work. 3. Generate report of work carried out. 4. Present the work carried out.
27.	IV	**CES4011**	**Dissertation phase-III**	1. Perform experimental/software analysis for developing research work. 2. Generate report work carried out. 3. Present the work carried out
28.	IV	**CES4021**	**Dissertation phase-IV**	1. Perform experimental/software analysis for developing research work. 2. Generate report work carried out. 3. Publish a research paper in journals/conference. 4. Prepare report using total work done as dissertation report. 5. Present the work carried out.

- **Department Name :- Department of Civil Engineering**
- **PG Program Name: M Tech Construction Management**
- **Vision and Mission :-**

Department Vision:

To be an outstanding department devoted to provide high end research, technical education in Civil engineering which will produce socially aware professionals to provide solutions to global community.

Department Mission:

- To design curriculum based on changing needs of stakeholders & provide excellence in delivery & assessment to ensure holistic development of civil engineering students.
- To enhance research & consultancy resulting in solving problems related to civil engineering infrastructure as well as society at large.
- To mentor students in pursuit of higher education, entrepreneurship and global professionalism.

Sr. No.	Program Outcomes
1.	An ability to independently carry out research /investigation and development work to solve practical problems.
2.	An ability to write and present a substantial technical report/document.
3.	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
4.	An ability to Analyze, evaluate, and select computer applications for the purpose of efficient and effective construction project management.
5.	An ability to Analyze construction projects relative to fundamental aspects of construction management (i.e., cost, schedule, quality, safety, ethics) and develop appropriate solutions
6.	Apply ethical business principles and Demonstrate responsibility for safety planning and productivity in construction management settings.

Sr. No.	Program Specific Outcomes
1.	Enhance employability and/or entrepreneur skills through in-house and onsite training.
2.	Provide solutions/procedures to societal and rural development problems through research and innovative practices.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	I	**CCM1014**	**Construction Project Management**	1. Implement project management framework. 2. Develop time schedules for projects.

				3. Identify and control project cost, quality, human resources and communications. 4. Apply project management information system for construction projects.
2.	I	**CCM1024**	**Construction Equipment & Techniques**	1. Compute productivity of various earthmoving equipment. 2. Analyze economics of project execution. 3. Select optimum equipment for construction of particular task. 4. Develop method statement for construction task. 5. Select equipment based on method statement
3.	I	**CCM1034**	**Ground Improvement Techniques**	1. Apply principles of ground improvement techniques. 2. Assess the most appropriate ground improvement techniques in specific circumstances. 3. Carry out laboratory and in situ tests for soil improvement. 4. Justify the applications of soil improvement methods on projects.
4.	I	**CCM1041**	**Operations Research**	1. Formulate and analyze the managerial problem through or models and arrive at an optimal solution or decision 2. Select appropriate method for decision making. 3. Apply nonlinear programming for managerial problems.
5.	I	**CCM1054**	**Resource Management**	1. Develop codes for material classification, 2. Select vendor for material procurement, 3. Apply inventory control models for materials management. 4. Describe employee development and welfare, 5. Develop performance appraisal matrix.
6.	I	**CCM1064**	**Total Quality Management**	1. Derive strategic plan for TQM. 2. Develop framework for TQM. 3. Apply quality management systems. 4. Examine suitable systems for TQM.
7.	I	**CCM1074**	**Bridge Construction**	1. Select location for bridge through geotechnical investigation data. 2. Perform hydrological calculations of design parameters. 3. Apply standard loadings and safety consideration for bridge design. 4. Select appropriate bridge superstructure elements for bridges.
8.	I	**CCM1084**	**Construction Materials**	1. Justify the need of new material development.

				2. Choose material for construction process based on material properties.
9.	I	**CCM1094**	**Project Formulation & Appraisal**	1. Perform technical and financial analysis of construction projects, 2. Perform BC ratio analysis, 3. Select project based on appraisal, 4. Develop administration process for project execution.
10.	I	**CCM1104**	**Construction Waste Management**	1. Develop strategies for construction and demolition waste management and resource efficiency. 2. Examine the environmental impact of building materials. 3. Design site waste management plans. 4. Justify the application of waste minimization techniques on construction site.
11.	I	**CCM1114**	**Research Methodology & IPR**	1. Prepare abstract through literature review. 2. Formulate a research problem. 3. Prepare and present research proposal/paper by following research ethics. 4. Prepare and present a report on Intellectual Property Rights.
12.	I	**SHP551**	**Technical Communication**	1. Acquire skills required for effective oral and written communication. 2. Demonstrate improved writing and reading skills.
13.	I	**CCM1124**	**Quantity Surveying Lab**	5. Develop drawings as per software requirement 6. Compute quantities of building items using software. 7. Prepare abstract sheet from the estimated quantities.
14.	I	**CCM1134**	**Project Planning Lab I**	1. Develop Work Breakdown Structure for project. 2. Prepare project schedule using Microsoft project. 3. Modify construction schedule based on site progress. 4. Extract and present various types of reports.
15.	II	**SHP526**	**Numerical Computational Method**	7. Use various statistical notions to model the problems. 8. Use relevant probability distribution to various problems. 9. Apply sampling and testing methods to distribute the given data. 10. Solve problems on correlation and regression.

16.	II	**CCM2014**	**Project Economics & Financial Management**	1. Select the best project of different alternatives. 2. Analyze projects using different techniques. 3. Identify and suggest sources of finance. 4. Analyze different financial statement. 5. Prepare and maintain different site accounts for civil engineering projects
17.	II	**CCM2024**	**Construction Contracts**	1. Identify applications of contract types for construction projects. 2. Develop tender document for construction project. 3. Perform comparative analysis of types of contract. 4. Analyze arbitration documents for construction project.
18.	II	**CCM2034**	**Special Construction Methods**	1. Select proper technique and equipment for a project, 2. Decide type of pile foundation for a project, 3. Plan site investigation.
19.	II	**CCM2044**	**Health & Safety Management**	1. Classify hazards to employees on construction site 2. Determine safe practices necessary for a project site 3. Identify the causes of accidents and suggest preventive measures to avoid accident. 4. Prepare safety management plan.
20.	II	**CCM2054**	**Lean Construction**	1. Compare lean and conventional production management. 2. Develop framework for lean construction application. 3. Apply lean construction techniques to construction projects. 4. Analyze and present case studies.
21.	II	**CCM2074**	**Value Engineering**	1. Perform value analysis, 2. Develop life cycle process of a project, 3. Apply Value Engineering methods, 4. Perform valuation of an asset.
22.	II	**CCM2084**	**Building Maintenance**	1. Investigate design factors influencing services selection, 2. Select sustainable building services for a project. 3. Develop process for testing and commissioning of building service system. 4. Analyze impact of various parameters on Life Cycle Cost of project.

23.	II	**CCM2094**	**Project Planning Lab II**	1. Prepare schedule plan for construction project. 2. Develop residential building construction project in primavera software 3. Analyze construction project using primavera. 4. Prepare and present various types of reports.
24.	II	**CCM2104**	**Geographic Information System Laboratory**	1. Justify the application of GIS in construction industry. 2. Analyze data using GIS software. 3. Prepare and present maps in GIS.
25.	II	**CCM2114**	**Industry Internship**	1. Relate theory to practice. 2. Compile technical data of the project. 3. Prepare daily work reports of ongoing activities. 4. Prepare and present internship report.
26.	II	**CCM2124**	**Miniproject**	1. Select mini project problem. 2. Prepare and present statement of purpose. 3. Develop solution to the selected problem. 4. Prepare and present report.
27.	III	**CCM3022**	**MOOC**	1. Apply techniques / processes / tools learned through MOOC in appropriate situation.
28.	III	**CCM 3012**	**Industrial Training**	6. Identify training area. 7. Prepare on site work report of training. 8. Perform analysis work. 9. Communicate with agencies. Generate report and Present the work carried out
29.	III	**CCM3042**	**Dissertation Phase-I**	1. Identify research problem through literature survey. 2. Develop research design for research problem. 3. Prepare and present synopsis report.
30.	III	**CCM3052**	**Dissertation Phase-II**	1. Perform data/experimental data collection for the project. 2. Analyze collected data using appropriate tools/techniques/ software's. 3. Perform experimental/software analysis for validation of research work. 4. Prepare and present report.
31.	IV	**CCM4012**	**Dissertation Phase-III**	1. Analyze collected data using appropriate tools/techniques/ software's. 2. Prepare and present/publish technical paper. 3. Prepare and present report.

32.	IV	**CCM4022**	**Dissertation Phase-IV**	1. Compile the work done in appropriate sequence. 2. Derive conclusion of the work done of the project. 3. Analyze proposed system. 4. Perform plagiarism analysis of compiled report. 5. Prepare and present the final dissertation report in desired format.

Computer Science & Engineering

Department Name :-Computer Science & Engineering
UG Program Name :- B. Tech in Computer Engineering
Vision and Mission :-
Vision:
To excel in the computer science engineering discipline through continuous research, innovation and industry-oriented curriculum leading to responsible IT professionals.
Mission:
1. To inculcate teaching and learning process promoting state-of-the-art IT industry practices in computer science engineering and technology to address global challenges.
2. To integrate academics, research and entrepreneurship skills to address present and future challenges of the society and industry.
3. To develop professionalism with strong foundations adapting to changing technology.

Sr. No.	Program Outcomes
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.	E**nvironment 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.

Sr. No.	Program Specific Outcomes
1.	Apply knowledge of database management systems, data mining and analytics techniques to solve real world problems
2.	Apply knowledge of machine learning and intelligence to identify, formulate and solve complex engineering problems
3.	Design, develop and deploy software using emerging IT technologies like open source tools, mobile application development platforms, web technologies and cloud computing

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	III	(CS2012)	Computer Organization	CO 1. To conceptualize basics of organizational and architectural issue ,functional unit of processor in digital computer and apply in computer organization
				CO 2. Construct the ability to perform computer arithmetic operations such as binary, signed, decimal, hexadecimal, floating point numbers.
				CO 3. Interpreting memory organization that uses banks for different word size operations and cache mapping techniques including translation, allocation.
				CO 4. Ability to understand input/output organization, data transfer techniques for computer.
				CO 5. To analyze processor performance improvement using instruction level parallelism in digital computer.
2.		(CS2032)	Data Structure & Algorithms	CO1: Compare between linear and nonlinear data structures.
				CO2: Describe the characteristics of various data structure such as stacks, queues, trees, graphs and Hash tables.
				CO3: Analyze various searching and sorting algorithms and apply it to solve particular problem.
				CO4: Determine a suitable data structure and algorithm to solve a real world problem.
3.		(CS2052)	Digital Electronics	CO1: Perform various arithmetic operations on different number system
				CO2: Apply Boolean algebra to solve logic functions
				CO3: Design, implement, and analyse various logic circuits
				CO4: Apply the programming techniques in developing the assembly language program for microprocessor system
4.		(CS2072)	Discrete Mathematics	CO1: Express mathematical statements using logical connectives.
				CO2: Analyze and perform operations associated with sets.
				CO3: Distinguish between relations and functions.
				CO4: Describe the concept of lattices and Boolean algebra.
				CO5: Apply graph theory concepts to solve problems of connectivity.

5.		(CS2091)	Operating System	CO1: Explain basic concepts of operating system like memory management.
				CO2: Apply scheduling techniques to solve real world problems.
				CO3: Calculate average waiting time, page faults.
				CO4: Differentiate different operating systems according to their features.
				CO5: Solve scheduling problem using different scheduling algorithms.
6.		(CS2112)	Advanced C Programming Lab	CO1: Learn advanced C topics like command line arguments, file handling, pointers, dynamic memory allocation, and Macros.
				CO2: Implement. Compile and Debug complex C programs.
				CO3: Solve tricky questions on C programming.
				CO4: Analyze given C program carefully and guess the output of same.
				CO5: Develop problem solving skills among students using C programming.
7.		(CS2132)	Data Structure & Algorithms Lab	CO1: Implement various data structures in C Language.
				CO2: Write and execute basic algorithms in C language.
				CO3: Choose appropriate data structure to develop a real time application.
				CO4: Analyze and compare the static and dynamic implementations of various data structures
8.		(CS2152)	Digital Electronics Lab	CO1: Demonstrate different types of gates.
				CO2: Design various logic circuits
				CO3: 3. Draw flowchart and apply assembly language programming techniques to develop the assembly language program for microprocessor system.
9.		(CS2172)	Comprehensive Exam-I	CO1: Choose proper techniques to find solution for engineering problems
				CO2: Solve various types of problems
				CO3: Develop ability to face competitive examinations
				CO4:Inspect the problem & conclude with proper solution
10.		(SH 2592)	Choice based soft skill Program-I & II Personal Effectiveness and Body Language Lab	CO1: Develop skills to build self-esteem and positive attitude
				CO2: Discover ways to overcome procrastination.
				CO3: Demonstrate responsiveness towards stress and health issues.
				CO4: Interpret the non-verbal behaviour of a person.
11.		(SH 2612)	Interpersonal Skills (Work life Balance)	CO1: Exhibit interpersonal communication skills.
				CO2: Demonstrate decision-making skills.
				CO3: Apply conflict resolution styles appropriate in different situations.
				CO4: Demonstrate leadership skills.

12.		(SH 2632)	Leadership and Public Speaking	CO1: Exhibit the ability to work effectively in team.
				CO2: Describe the traits of a leadership through real life examples.
				CO3: Plan the speech as per the audience and context requirements.
				CO4: Analyze public speeches.
13.		(SH2692)	Innovation Tools & Methods for Entrepreneurs	CO1: Learn structured approach to define the problem with every possible detail, identify conflicts and solve them
				CO2: Apply User Journey Map to the selected problem to show user interaction at various stages
				CO3: Analyze the solutions provided by competitors for effectiveness and gaps if any
14.		(SH 2732)	German Language-Basic Level	CO1: Introduce herself or himself in German.
				CO2: Can listen and understand alphabets, numbers in German language.
				CO3: Make basic and easy sentences required in day to day situations.
				CO4: Read, write, speak and listen basic and simple text in German.
15.		(SH 2712)	Japanese Language-Basic Level	CO1: To get the students acquainted with foreign language.
				CO2: To gain knowledge of basic Japanese grammar.
				CO3: To acquire basic Japanese language skills (listening, speaking, writing, and reading).
				CO4: To enable students, demonstrate an awareness of the relevance of Japanese language to professions and careers.
				CO5: To make students understand the cultures and civilizations of the country of Japan.
				CO6: To enable the students to function in an environment where Japanese is used exclusively.
16.	IV	(CS2002)	Computer Networks	CO1: Identify and explain the modulation techniques, components used in a communication system.
				CO2: Identify different Network models and protocols of different layers
				CO3 Discuss the concept multiplexing & switching.
				CO4: Recognize and discuss the functions the different protocols in network layer
				CO5: Identify the proper transmission control protocol for given applications
				CO6: Explain the different services at application layer.
17.		(CS2022)	Formal Language & Automata Theory	CO1: Apply the mathematical techniques for solving the automata problem.
				CO2: Implementation of compiler with the help finite machine model.

				CO3: Build regular expressions for the regular languages.
				CO4: Design a various computation machines like finite automata, pushdown automata, and I uring machines.
				CO5: Analyze the finite machine model.
18.		(CE2062)	Engineering Mechanics	CO1: Identify various forces and their effects, to analyze real life problems.
				CO2: Analyze engineering problems applying conditions of equilibrium.
				CO3: Determine Centroid & Moment of Inertia of the geometrical plane lamina
				CO4: Apply fundamental concepts of Kinematics and Kinetics to analyze practical problems.
19.		(SH2022)	Engineering Mathematics-III	CO1: Compute Karl Pearson's Product moment correlation Coefficient and tit the lines of regression.
20.				CO2: Compute discrete probability distribution. Continuous probability distributions and Joint probability distributions.
				CO3: Apply specific probability distributions to real-life examples.
				CO4: Compute the Mathematical formulas for the given fuzzy set.
				CO5: Prove additional properties of alpha-cuts and use extension principle to fuzzy sets.
				CO6: Apply extension principle to fuzzy arithmetic and solve fuzzy equations.
21.		(CS2042)	Computer Network Lab	CO1: Define and apply architectural principles and mechanisms for data exchange among computer
				CO2: Design, implement and analyse simple computer networks.
				CO3: Identify& analyse the performance of different network layer protocols to formulate and solve network-engineering problems.
				CO4: Identify Operations of TCP/UDP, FTP, HTTP, SMTP, SNMP etc.
				CO5: Analyse to compare performance of different routing protocols.
				CO6: Compare different networking models.
				CO7: Ability to use techniques, skills, and modern networking tools necessary for engineering practice.
				CO8: Demonstrate an understanding of computer communications standards
22.		(CS2062)	Object Oriented Design and Programming Lab	CO1. Understand object-oriented design concepts and apply them in software system design.
				CO2. Implement basic oop concepts like class & object, inline functions, dynamic memory allocations etc..
				CO3. Use constructors, destructors, function overloading, operator overloading, and friend functions in c++.
				CO4. Use c++ for implementing different types of inheritance and virtual functions.

				CO5. Apply advanced features of c++ programming like exception handling, templates etc.
23.		(CE2282)	Engineering Mechanics Lab	CO1: Compare coefficient of friction of various surfaces in contact.
				CO2: Correlate theoretical and practical results of support reactions and Centroid of plane lamina.
				CO3: Verify law of polygon of forces, law of triangle of forces and principle of moment.
24.		(SH2172)	Environmental Science	CO1: Study the importance and sensitivity of environment.
				CO2: Interpret the over exploitation of natural resources and follow the environmental ethics.
				CO3: Explain methods to protect environment and prevent environmental pollution
				CO4: Apply their knowledge and skills to solve their environment related problems.
		(SH2602)	Environmental Science Project	CO1: Utilize scientific methods to solve environmental problems
				CO2: Examine technologies for restoration of degraded environment
				CO3: Develop presentation and report writing skills
				CO4: Develop as an individual and in group leadership quality
25.		**CS2082**	Comprehensive Exam – II	CO1: Choose proper techniques to find solution for engineering problems
				CO2: Solve various types of problems
				CO3: Develop ability to face competitive examinations
				CO4: Inspect the problem & conclude with proper solution
26.		(SH 2592)	Open Elective-III Choice based Soft Skills Program-II Personal Effectiveness and Body Language Lab	CO1: Develop skills to build self-esteem and positive attitude.
				CO2: Discover ways to overcome procrastination.
				CO3: Demonstrate responsiveness towards stress and health issues.
				CO4: Interpret the non-verbal behaviour of a person.
27.		SH2612	Interpersonal Skills (Work life Balance)	CO1: Exhibit interpersonal communication skills.
				CO2: Demonstrate decision-making skills.
				CO3: 3. Apply conflict resolution styles appropriate in different situations.
				CO4: Demonstrate leadership skills.
28.		(SH 2632)	Leadership and Public Speaking	CO1: Exhibit the ability to work effectively in team.
				CO2: Describe the traits of a leadership through real life examples.
				CO3: Plan the speech as per the audience and context requirements.
				CO4: Analyze public speeches.

29.		(SH2692)	Innovation Tools & Methods for Entrepreneurs	CO1: Learn structured approach to define the problem with every possible detail, identify conflicts and solve them
				CO2: Apply User Journey Map to the selected problem to show user interaction at various stages
				CO3: Analyze the solutions provided by competitors for effectiveness and gaps if any
30.		(SH 2642)	German Language-Advanced Level	CO1: Introduce herself or himself in German.
31.				CO2: Can listen and understand alphabets, numbers in German language.
				CO3:Make basic and easy sentences required in day to day situations
				CO4: Read, write, speak and listen basic and simple text in German.
32.		(SH 2622)	Japanese Language-Advanced Level	CO1: To get the students acquainted with foreign language.
				CO2: To gain knowledge of basic Japanese grammar.
				CO3: To acquire basic Japanese language skills (listening, speaking, writing, and reading).
				CO4: To enable students, demonstrate an awareness of the relevance of Japanese language to professions and careers.
				CO5: To make students understand the cultures and civilizations of the country of Japan.
				CO6: To enable the students to function in an environment where Japanese is used exclusively.
33.		(CS3012)	Database Management Systems	CO1: Express terms related to database design and management.
				CO2: Apply the relational algebra structured query language (sql) for database definition and manipulation.
				CO3: To use concept of functional dependency and decompose schema by applying certain normal forms.
				CO4: Apply ethical computing concepts and practices to design database and implementation (security, concurrency control , recovery, deadlock handling)

				CO5: To design and create database to solve real world problem.
34.	V	(CS3032)	System Software	CO1: Explain the role of system programs in development phase and able to apply appropriate knowledge of computing
				CO2: Illustrate the logical analysis & design aspect of macro with macro pre-processing activities
				CO3: Determine the aspect of language processing from linker and loaders perspective
				CO4: Analyze different phases of compilers and practice the compiler construction tools such as LEX and YACC to build systems program modules
				CO5: Design an effective intermediate and optimized code generator
				CO6: Describe the various properties of optimization and generation
35.		(CS3051)	Operating System	CO1: Explain basic concepts of operating system like memory management.
				CO2: Apply scheduling techniques to solve real world problems.
				CO3: Calculate average waiting time, page faults.
				CO4: Differentiate different operating systems according to their features.
				CO5: Solve scheduling problem using different scheduling algorithms.
36.		(CS3052)	Design and Analysis of Algorithm(CS3052)	CO1: Explain the basic concepts of time and space complexity, divide-and-conquer strategy, dynamic programming, greedy and approximate algorithms, amortized analysis and computational geometry.
				CO2: Prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
				CO3: Identify and apply appropriate algorithm design techniques for solving problems.
				CO4: Design an algorithm to solve problem in different domains.
				CO5: Explain non-deterministic and randomized algorithms
37.		(CS3072)	Program Elective – I Open Source Technologies (CS3072)	CO1: Apply fundamentals of Python to solve real world problems
				CO2: Use appropriate control structures in Python to optimize the program
				CO3: Apply the knowledge of File Operations to read and write files using Python
				CO4: Apply Object Oriented Programming concepts using Python for real world problems
				CO5: Develop a program in Python to handle the exceptions

				CO6: Demonstrate the knowledge of RDBMS and Python programming to build database-based applications
38.		(CS3092)	Program Elective – I Web Technology	CO1: Design static and dynamic web pages using scripting languages like HTML and CSS
39.				CO2: Develop a dynamic web application using JavaScript and jQuery to demonstrate data validation
				CO3: Demonstrate knowledge of Angular JS by designing dynamic web applications
				CO4: Develop a server-side web application using PHP
				CO5: Implement advanced PHP libraries for feature rich web application
				CO6: Demonstrate the knowledge of advanced PHP using standard PHP frameworks
40.		(CS3112)	Program Elective – I Mobile Application Development (CS3112)	CO1:Setup the Android development environment
				CO2:Utilize the appropriate User Interface controls in Android app
				CO3: Implement SQLite and Shared Preferences concepts to store data in Android app
				CO4:Implement Location and Notification based functionalities in Android app
				CO5: Design and develop a Web View based Android app
				CO6: Build and deploy Android app on Google Play Store
41.		(CS3132)	Program Elective – I Network Programming	CO1: Show various concepts related with network programming using C, C++,
				CO2: Implement Socket programming in C++ using different Socket options.
				CO3: Exhibit TCP Client Server communication using network programming.
				CO4: Demonstrate UDP socket programming and Name resolutions.
				CO5: Apply inter-process communication and RPC in given context.
42.		(CS3172)	Database Management Systems Lab	CO1: Sketch E-R diagram for given Case Study/ Problem Statement.
				CO2: Design relational database using Normalization and Functional Dependency.
				CO3: Implement SQL query for various operations like retrieval, insertion and manipulation of data etc.
				CO4: Implement PL/SQL cursor, procedure, function and trigger
				CO5: Apply hashing mechanism to build hash index file on given records.

				CO6: Develop a program to connect database to an application program
		(CS3152)	Java Programming Lab	CO1: Demonstrate OO features by implementing Java programs.
				CO2: Use Java Language for various programming constructs/technologies.
				CO3: Choose an engineering approach to solve problem based on the knowledge of Programming and Operating System.
				CO4: Build GUI to meet user's GUI requirements.
43.		(SH3032)	Aptitude Training I	CO1: Develop a thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning problems.
				CO2: Understand usage of basic aptitude terms of percentages, averages, ratios and applications of business aptitude terms of profits and interests
				CO3: Develop a bridge in analogies, series and visualizing directions.
				CO4: Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams.
44.		(CS3192)	Comprehensive Exam - III	CO1: Choose proper techniques to find solution for engineering problems
				CO2: Solve various types of problems
				CO3: Develop ability to face competitive examinations
				CO4: Inspect the problem & conclude with proper solution
45.		(SH301)	Indian Constitution	CO1: Create awareness about law depiction and importance of Constitution
				CO2: Define Fundamental Rights and Fundamental Duties of the Indian Citizen to instill morality, social values, honesty, dignity of life and their social Responsibilities.
				CO3: Create Awareness of their Surroundings, Society, Social problems and their suitable solutions while keeping rights and duties of the citizen keeping in mind.
				CO4: Recognize distribution of powers and functions of Local Self Government.

				CO5: Comprehend the National Emergency, Financial Emergency and their impact on Economy of the country.
46.		(CS3212)	Summer Internship/ Professional Certification	CO1: Find possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job
				CO2: Explore the current techno logical developments relevant to the subject area of training.
				CO3: Apply the Technical knowledge in real industrial situations
				CO4: Gain experience in writing Technical reports/projects.
				CO5: Expose engineer's responsibilities and ethics
				CO6: Understand the social, economic and administrative considerations that influence the working environment of industrial organizations
				CO7: Understand the psychology of the Employees and their attitudes and approach to problem solving
47.	VI	(CS3002)	Program Elective-II Linux Operating System	CO1:Recall the basic concepts of Linux Operating system and basic commands
				CO2: Writes shell programming using C
				CO3: Familiarize with system calls for file system, Structure of process, Memory management Policies, and 10 Subsystem in LINUX.
				CO4: Analyze Linux utilities, principles of Linux programming and compare with other operating system.
48.		(CS3222)	Program Elective-II Linux Operating System Lab	CO1: Students will gain Good working knowledge of Linux from Both Graphical and command Line Perspective.
				CO2: Students will Gain knowledge about managing file system in Linux.
				CO3; Students will Gam knowledge about Managing Red Hat Enterprise Linux Networking.
				CO4: Gain sufficient skill to perform core system administration tasks on Red Hat Enterprise Linux.
49.				CO5: Build foundational skills needed by an RHCSA-certified Red Hat Enterprise Linux system Administrator
50.		(CS3022)	Program Elective-II	CO1: Explore methods for solving

			Advanced Algorithms	recurrences, which are useful for describing the running times of recursive algorithms
				CO2: Formulate the graph search algorithms and network flow problems
				CO3:Analyze the knowledge about number - theoretic algorithms
				CO4:Articulate the string - matching algorithms
				CO5: Introduce the probabilistic analysis and randomized algorithms
51.		(CS3242)	Program Elective-II Advanced Algorithms Lab	CO1: Apply mathematical background for analysis of algorithm
				CO2: Explore the concept of designing an algorithm.
				CO3: Implement various algorithms of graphs, theoretical foundations and approximations.
				CO4: Implement the concept of pattern matching algorithms.
				CO5: Implement polynomial and FET algorithms.
52.		(CS3042)	Program Elective-II Parallel Programming	CO1: Identify compute intensive part from sequential algorithm.
				CO2: Design parallel algorithm from given sequential algorithm.
				CO3: Develop parallel programs to use multi-core processors using OpenMP
				CO4: Write parallel programs to demonstrate various features of CUDA C/C++
				CO5: Explore different compute intensive applications.
53.		(CS362)	Program Elective-II Parallel Programming Lab	CO1: Design different parallel algorithms to solve compute intensive problems.
				CO2: Use different parallel programming languages on multi-core and many-core

				systems.
				CO3: Perform the analysis with different performance metrics.
54.		(CS3062)	Program Elective-II Cloud Computing	CO1: Describe fundamental concepts of cloud computing and its Architecture
				CO2: Explain the core concepts of Virtualization
				CO3: Differentiate and analyze the components of various cloud platforms
				CO4: Explain the key components of Amazon web Services
				CO5: Analyze the applications of Cloud Computing in different domains
55.		(CS3282)	Program Elective-II Cloud Computing Lab	CO1: Implement Infrastructure, storage as a Service
				CO2: Design and deploy a web application in a PaaS environment
				CO3: Install and use a generic cloud environment that can be used as a private cloud
				CO4: To gain competence in evaluating the performance and identifying bottlenecks when mapping applications to the cloud
56.		(CS3082)	Program Elective-III Soft Computing	CO1: Explain the principles and basic concepts of Soft Computing techniques
				CO2: Identify the logic of fuzzy rule-set and its reasoning
				CO3: Classify the need for supervised — unsupervised neural models and its application
				CO4: Analyze the Evolutionary techniques with traditional techniques
				CO5: Apply the hybrid learning techniques for providing computationally intelligence solutions
57.		(CS3302)	Program Elective-III Soft Computing Lab	CO1: Imparting the architectural concepts of traditional algorithms for NP problems

				CO2: Introducing membership concepts required for logical programs
				CO3: Analyzing neural network libraries for model formations
				CO4: Applying Fuzzy Control Design for real world scenarios
				CO5: Experimenting genetic/evolutionary operators for various NP problems
58.		(CS3102)	Program Elective-III Advanced Database System	CO1: Evaluate and describe the fundamental theories and requirements that influence the design of modern database systems.
				CO2: Describe and compare client-server, distributed & parallel database.
				CO3: Make use of object relational database and xml for different application in database.
				CO4: Demonstrate handling and administration of real time systems.
				CO5: Discuss concept of data warehousing, security and different case studies like PostgreSQL etc.
59.		(CS3322)	Program Elective-II Advanced Database System Lab	CO1; Implement various partitioning techniques in parallel database environment
				CO2: Implement various operations of database using parallelism approach
				CO3: Implement inheritance concept in parallel database
				CO4: Implement the query for complex database
				CO5: Implement object-oriented database
60.		(CS3122)	Program Elective-III Object Oriented Modelling and Design	CO1: Comprehend basics of object oriented modelling and compare the need of object-oriented modelling with traditional methods.
				CO2: Propose software system using requirements/feature lists, use cases, and simple structural of UML models.
				CO3: Demonstrate knowledge of functional and behavioural modelling techniques.
				CO4: Design a software system based on advanced static/dynamic UML models.
				CO5: Analyze the application domain and requirements of the problem. Develop the skills to determine which processes and OOAD techniques should be applied to a given project.
				CO6: Able to work in teams to perform the above techniques as well as the ability to translate UML models into code using an OO programming language.
61.		(CS3342)	Program Elective-III	CO1: Comprehend basics of object-oriented modeling and compare the need of object-oriented modeling with traditional methods

			Object Oriented Modelling and Design Lab	CO2: Propose software system using requirements/feature lists, use cases, and simple of structural UML models
				CO3: Demonstrate knowledge of functional and behavioural modelling techniques
				CO4: Design a software system based on advanced static/dynamic UML models
				CO5: Develop the skills to determine which processes and OOAD techniques should be applied to a given project
				CO6: Able to work in teams to perform the above techniques as well as the ability to translate UML models into code using an 00 programming language
62.		(CS3142)	Program Elective-III Technology Trends	CO1: Explore LAN design.
				CO2: Describe the functions of spanning tree protocols.
				CO3: Explore the functionality of network layer
				CO4: Synthesize the functionality of Ether Channel, HSRP and Dynamic Routing
				CO5: To learn Internet of Things Technology
				CO6: Contrast the concept of software defined networking
63.		(CS3362)	Program Elective-III Technology Trends Lab	CO1: Explore LAN design
				CO2: Understand the functions of spanning tree protocols
				CO3: Understand the functionality of network layer
				CO4: Understand the functionality of Ether Channel, HSRP and Dynamic Routing
				CO5: To learn Internet of Things Technology
				CO6: Understand Software Defined Networking
64.		(CS3162)	Information Security	CO1: Analyze different methods of Data Encryption and Decryption; their advantages & limitations.
				CO2: Use different key distribution methods for distribution of Public/Private & Secret keys

				CO3: Apply message authentications techniques for implementing security during message communication
				CO4: Create and use digital signatures
				CO5: Discuss different security attacks & security solutions for e-mail & web applications
65.		(SH302)	Biology for Engineers	CO1: Apply biological engineering principles, procedures needed to solve real-world problems
				CO2: Demonstrate the functions of biological systems
				CO3: Analyze biological phenomena with math and physics to gain important insights
				CO4; Explain working of different biomedical instruments
				CO5: Select the sensors for given biological applications
				CO6: Explain relevant aspect of movement control process
66.		(CS3182)	Capstone Project Phase-I	CO1: Apply knowledge of computer science for real world problem.
				CO2: Possess Professional, Practical and reflective practitioner skills.
				CO3: Upgrade and apply the knowledge through continuous learning.
				CO4: Effectively apply Design Thinking Processes and Template to structure learning lifecycle in the development of a prototype.
				CO5: To develop project management and time management skills
				CO6: To formulate a process whereby to keep the end-user or customer in mind throughout the project lifecycle.
67.		(CS3202)	.Net Programming Lab	CO1: Explain the most important features of .NET Framework technology
				CO2:Developing Console and Windows application by using C# language

				CO3:Implement OOP concepts like data encapsulation, data hiding, inheritance and polymorphism using C# language
				CO4:Analyze and implement advanced features of C# language like multithreading, exceptions and delegates
				CO5:Developing projects in C# that include control structure, looping, file handling event handling, ADO.NET, multithreading etc
68.		(SH3042)	Aptitude Training- II	CO1: Develop a thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning Problems
				CO2: Understand usage of aptitude terms of speed, time and distance and permutations, probabilities and applications.
				CO3: Understand blood relations and ways of seating arrangements along with various geometrical figures
				CO4: Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams
69.		(CS3382)	Comprehensive Exam – IV	CO1: Choose proper techniques to find solution for engineering problems
				CO2: Solve various types of problems
				CO3: Develop ability to face competitive examinations
				CO4: Inspect the problem & conclude with proper solution
70.	VII	(CS4012)	Machine Learning	CO1: Identify and describe the characteristics of machine learning that make it useful to the real-world problems.
				CO2: Apply clustering and bayesian decision theory to classify given data.
				CO3: Sketch decision tree using various decision tree building algorithms.
				CO4: Describe inference and learning algorithms for the hidden Markov model.

				CO5: Explain different reinforcement learning algorithms.
71.		(CS4032)	Program Elective-IV Data Mining	CO1: Analyze the aspect of mining data over the statistical techniques for selected applications
				CO2: Justify the usage of various classification/clustering algorithms
				CO3: Apply knowledge to build association based rules technique for real world case studies
				CO4: Explore data warehousing and OLAP concepts
				CO5: Experiment the advancement in mining techniques for wide variety of areas
72.		(CS4292)	Program Elective-IV Data Mining Lab	CO1: Analyze the aspect of Weka tool over the statistical techniques
				CO2: Demonstrate various classification/clustering algorithms on huge data sets
				CO3: Implement association based rules mining approaches on real world case studies
				CO4: Instrument data warehousing and OLAP concepts on complex data objects
				CO5: Experiment the advancement in mining techniques for wide variety of areas
73.		(CS4052)	Program Elective-IV Software Testing & Quality Assurance	CO1: Demonstrate various terms and technologies used in testing domain.
				CO2: Apply the software testing techniques in commercial environments.
				CO3: Design different test plan and test cases for software quality improvement.
				CO4: Choose suitable open source testing & automation tools.
				CO5: Use various types of software tests and quality control standards
74.		(CS4312)	Program Elective-IV Software Testing & Quality Assurance Lab	CO1: Describe the fundamental concepts of software testing and quality assurance.
				CO2: Create and implement an effective software testing strategy.
				CO3: Implement various lest processes and continuous quality improvement.

				CO4: Apply application of software testing techniques in commercial environments.
75.		(CS4072)	Program Elective-IV Wireless Networks	CO1: Differentiate between Wired Networks and Wireless Networks.
				CO2: Identify challenges in designing wireless networks and discuss possible solutions to overcome these challenges.
				CO3: Review architectures of various wireless technologies like 3G,4G, WiFi etc.
				CO4: List issues in working of Wireless adhoc networks and discuss techniques to address these issues.
				CO5: Demonstrate working of different networking applications.
76.		(CS4332)	Program Elective-IV Wireless Networks Lab	CO1: Comment on difference between wireless and wired networks and possible challenges in the design of wireless networks.
				CO2: Identify design issues in various wireless technologies and discuss possible solutions for them.
				CO3:Review architectures of various access technologies such as 3G, 4G, WiFi etc.
				CO4: List challenges and possible solutions in various layers for Ad hoc networks
				CO5; Demonstrate working of different types of wireless network applications.
77.		(CS4092)	Program Elective – V Artificial Intelligence	CO1: Apply Artificial Intelligence techniques for problem solving
				CO2: Comprehend the abstractions and reasoning for Intelligent Agents
				CO3: Analyze and design a real-world problem for implementation
				CO4: Develop knowledge of decision making and learning methods
				CO5: Select appropriately from a range of techniques when implementing intelligent systems
78.		(CS4352)	Program Elective – V Artificial Intelligence Lab	CO1: Apply Artificial Intelligence techniques for problem solving
				CO2: Comprehend the abstractions and reasoning for Intelligent Agents
				CO3; Analyze and design a real-world problem for implementation

				CO4: Develop knowledge of decision making and learning methods
				CO5: Select appropriately from a range of techniques when implementing intelligent systems
79.		(CS4372)	Program Elective – V Software Engineering	CO1: Identify requirements and apply process model to selected case study.
				CO2: Analyze and design models for the selected case study using UML modeling.
				CO3: Use various software engineering tools.
80.		Lab (S4372)	Program Elective – V Software Engineering	CO1: Identify requirements and apply process model to selected case study.
				CO2; Analyze and design models for the selected case study using UML modeling.
				CO3: Use various software engineering tools.
81.		(CS4132)	Program Elective – V Advanced Software Engineering	Co1; A recapitulation of software engineering process models.
				Co2: A recapitulation of the basic techniques for requirements engineering and design.
				Co3; Project management, Maintenance and re-engineering.
				CO4: Process and project metrics.
				CO5: Estimation for software projects and Project scheduling.
82.		(CS4392)	Program Elective – V Advanced Software Engineering Lab	CO1: A recapitulation of software engineering process models.
				CO2: A recapitulation of the basic techniques for requirements engineering and design.
				CO3: Project management, Maintenance and re-engineering.
				CO4: Process and project metrics.
				CO5: Estimation for software projects and Project scheduling.
83.		(CS4152)	Program Elective – V Internet of Things	CO1: Identify the various components of IoT.
				CO2: Design a middleware for IoT.
				CO3: Identify the issues to address the security, intelligence in IoT.
				CO4: Describe various protocols used in IoT.

				CO5: Establish the communication between IoT devices and cloud server using wireless technology.
				CO6: Develop IoT application to solve real world problems.
84.		(CS4412)	Program Elective – V Internet of Things Lab	CO1: Identify the components of IoT
				CO2; Design a middleware for IoT
				CO3: Develop IoT application to solve social problems
				CO4: Analyze various protocols for IoT
				CO5: Establish the communication to the cloud through Wi-Fi / Bluetooth
85.		(CS4172)	Program Elective – VI Natural Language Processing	CO1: Acquire knowledge of the fundamental mathematical models and algorithms in the field of NLP.
				CO2: Apply these mathematical models and algorithms in applications in software design and implementation for NLP.
				CO3: Apply deep learning models to solve machine translation and conversation problems.
				CO4: Apply deep structured semantic models on information retrieval and natural language applications.
				CO5: Acquire knowledge of the design and implementation issues in various NLP applications such as information extraction and Machine translation.
86.		(CS4192)	Program Elective – VI Big Data Analytics	CO1: Identify big data for business intelligence
				CO2: Explore the fundamental concepts of big data and its analytics
				CO3: Analyze the big data using Hadoop and intelligent techniques
				CO4: Apply NoSQL big data management underlying analytics framework
				CO5: Recognize the suitable secure models for building competitive business decisions
87.		(CS4212)	Program Elective – VI	CO1: To describe concepts of requirement

			Principles and Practices for IT Management	analysis, risk, budgeting a project, creating a work breakdown structure.
				CO2: Apply critical path method for project tracking and progress project.
				CO3: To demonstrate resource allocation and scheduling concepts.
				CO4: To apply strategies, policies and strategic management in project development.
				CO5: To classify Intellectual Property Rights and related laws.
				CO6: To develop IT application for marketing, health care, insurance, banking, agriculture and service sector.
88.		(CS4232)	Program Elective – VI Computer Graphics & Virtual Reality	CO1: Apply the mathematical techniques for representing points, lines, curves and surface in graphics
				CO2: Design algorithms to draw lines, circle, polygons, etc
				CO3: Demonstrate the knowledge of projections
				CO4: Learn the basics of OpenGL and emerging technologies using openGL and GLUT libraries
				CO5: Design a virtual environment
				CO6: List and describe graphic devices used in virtual reality system
89.		(CS4252)	Finance & Accounting	CO1: Explain the Indian financial system with its components.
				CO2: Evaluate financial and management accounting.
				CO3: Develop the ability in participants" to use financial statements to assess a company's performance.
				CO4: Estimate the software cost using various models.
90.		(CS4272)	Machine Learning Lab	CO1: Explore dataset and it associated

				characteristics using python libraries.
				CO2: Implement various supervised learning algorithms on given dataset.
				CO3: Propose solution for real world problem by implementing ML algorithms.
				CO4: Find the hidden patterns from given dataset by applying unsupervised learning algorithms.
91.		(CS4432)	Capstone Project Phase – II	CO1: Apply knowledge of computer science for real world problem.
				CO2: Possess Professional, Practical and reflective practitioner skills.
				CO3: Upgrade and apply the knowledge through continuous learning.
				CO4: Effectively apply Design Thinking Processes and Template to structure learning lifecycle in the development of a prototype.
				CO5; To develop project management and time management skills
				CO6: To formulate a process whereby to keep the end-user or customer in mind throughout the project lifecycle.
92.	VIII	(IP4022)	Track I Industry Internship and Project	CO1: Examine the functioning of the company on the terms of inputs, transformation process and the outputs (products and services)
				CO2: Develop an attitude to adjust with the company culture, work norms, code of conduct.
				CO3: Recognize and follow the safety norms, Code of conduct.
				CO4: Demonstrate the ability to observe, analyse and document the details as per the industry practices.
				CO5: Interpret the processes, systems and procedures and to relate to the theoretical

				concepts- studies.
				CO6: Improve the leadership abilities, communication.
				CO7:Demonstrate project management and finance sense
93.		(OE438) (IP4022)	Track I Finance for Engineers	CO1: Examine the functioning of the company on the terms of inputs, transformation process and the outputs (products and services)
				CO2: Develop an attitude to adjust with the company culture, work norms, code of conduct.
				CO3: Recognize and follow the safety norms, Code of conduct.
				CO4: Demonstrate the ability to observe, analyse and document the details as per the industry practices.
94.		(OE436)	Track I Engineering Management & Economics (Online Course)	CO1: Develop administrative, organizational and planning skills to execute engineering project.
				CO2: Develop bar chart/mile stone chart for the project.
				CO3: Analyze profit/cost data and carry out economic analysis to take optimal decision.
				CO4: Calculate depreciation as per various methods.
95.		(URE) (RE4042)	Track- II Undergraduate Research Experience	CO1: Investigate the technical literature.
				CO2: Recognize and evaluate theories, practices, and/or research on a chosen topic by conducting a thorough literature review and submitting a written integrative, critical summary of the current literature.
				CO3: Design a research problem and develop a methodology.
				CO4: Develop and implement an advanced original research or creative project.
				CO5: Develop the ability to explain the conceptual viability of the project and describe the major components involved.
				CO6: Develop the ability to explain how the project will impact the relevant body of work.
				CO7: Develop advanced discipline-relevant skills and competencies.

				CO8: Construct an accurate record of research performed.
				CO9: Write a research report and paper.
96.		(ED4082)	Track -III Entrepreneurship Development	CO1: Apply knowledge of engineering, economics, marketing and finance for preparation of project report.
				CO2: Make commercial, technical and financial appraisal of project.

Department Name:Computer Science and Engineering
PG Program Name:Computer Science and Engineering
Vision and Mission :-

Vision:
To excel in the computer science engineering discipline through continuous research, innovation and industry-oriented curriculum leading to responsible IT professionals

Mission:

- To inculcate teaching and learning process promoting state-of-the-art IT industry practices in computer science engineering and technology to address global challenges.
- To integrate academics, research and entrepreneurship skills to address present and future challenges of the society and industry.
- To develop professionalism with strong foundations adapting to changing technology.

Sr. No.	Program Outcomes
1.	Independently carry out research and development work to solve practical problems related to the Computer Science and Engineering domain
2.	Write and present a substantial technical report/document
3.	Demonstrate a degree of mastery over the area as per the CSE specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
4.	Apply knowledge of database management systems, data mining and analytics techniques to solve real world problems
5.	Apply knowledge of machine learning and intelligence to identify, formulate and solve complex engineering problems
6.	Design, develop and deploy software using emerging IT technologies like open source tools, mobile application development platforms, web technologies and cloud computing

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	I	**SHP5153**	Linear Algebra and Probability Distributions	Co: 1 Use relevant probability distribution to solve the engineering problems.
				Co: 2 Compute the rank of a matrix and solve the system of linear equations.
				Co: 3 Examine for dependency and determine the dimensions of vector space.
				Co: 4 Use different mathematical techniques to model and solve the problem
2.	I	**CSE1014**	**Machine Learning**	Co: 1 Set necessary mathematical background to understand Machine Learning concepts.

				Co: 2Recognize and appreciate need of Machine Learning in various applications.
				Co: 3Apply Classification and Regression techniques for decision making.
				Co: 4Use probabilistic graphical models to represent given problems.
				Co: 5Apply sequential data processing algorithms to solve problems
3.	I	**CSE1024**	**Advanced Algorithm**	Co: 1 Select appropriate algorithm design techniques such as greedy method, dynamic programming, backtracking and heuristic algorithms.
				Co: 2 Apply backtracking algorithm to solve real world problems.
				Co: 3 Explore different NP problems and approximation algorithmic solutions.
				Co: 4 Apply and design parallel algorithms to solve fundamental problems.
				Co: 5 Apply and compare performance of local search techniques algorithms for solving fundamental combinatorial problems.
				Co: 6 Compare and design global search techniques for solving engineering/real-world combinatorial problems.
				Co: 7 Identify the new trends and research directions in algorithms
4.	I	**CSE1034**	Program Elective-I **(Big Data)**	CO 1 Analyze big data for business intelligence
				CO 2 Learn business case studies for big data analytics
				CO 3 Implement map-reduce analytics using hadoop related tools
				CO 4 Apply NoSQL big data management
				CO 5 Manage big data with aspects of Privacy and ethic
5.	I	**CSE1044**	**Program Elective-I (Cloud Computing)**	CO1. Compare cloud computing with other computing technologies.
				CO2. Illustrate the virtualization technologies and its role in enabling the cloud computing system model.
				CO3. Identify and compare different cloud service and deployment models for scientific, business and consumer applications.
				CO4. Describe Aneka platform as a service to design different applications.
				CO5. Compare different cloud services with pros and cons from multiple cloud providers.
				CO6. Describe recent advances in cloud framework/services for solving scientific and business applications.
6.	I	**CSE1054**	Program Elective-I **(Open Source Technologies)**	CO1. Demonstrate the configuration of software services on servers. .
				CO2. Exercise the FOSS tools for the software development.
				CO3. Contribute to existing FOSS in FOSS environment
7.	I	**CSE1064**	**Program Elective-II (Natural Language Processing)**	CO1. Acquire knowledge of the fundamental mathematical models and algorithms in the field of NLP.
				CO2. Apply these mathematical models and algorithms in applications in software design and implementation for NLP.
				CO3. Apply deep learning models to solve machine translation and conversation problems.
				CO4. Apply deep structured semantic models on information retrieval and natural language applications.

				CO5. Acquire knowledge of the design and implementation issues in various NLP applications such as information extraction and Machine translation.
8.	I	**CSE107**	Program Elective –II **(Computer Vision)**	CO1. To implement fundamental image processing techniques required for computer vision
				CO2. Understand Image formation process
				CO3. To perform shape analysis
				CO4. Extract features form Images and do analysis of Images
				CO5. Generate 3D model from images
9.	I	**CSE1084**	Program Elective-II **(Advanced Networks)**	CO1. Discuss the design and research issues in wireless networks
				CO2. Demonstrate the working of 802.11 a/g/n wireless standard
				CO3. Apply the different types of routing protocols in ad-hoc networks.
				CO4. Analyze different protocols in MAC, Routing and TransCOrt Control for Sensor Networks
10.	I	**CSE1094**	**Research Methodology**	CO1.Formulate a research problem.
				CO2.Analyze research related information.
				CO3.Prepare and present research proCOsal / paper by following research ethics.
				CO4.Make effective use of computers and computing tools to search information, analyze information and prepare reCOrt.
				CO5.Describe nature and processes involved in development of intellectual property rights.
11.	I	**CSE1104**	**Machine Learning Laboratory**	CO1. Set necessary mathematical background to understand Machine Learning concepts.
				CO2. Recognize and appreciate need of Machine Learning in various applications.
				CO3. Apply Classification and Regression techniques for decision making.
				CO4. Use probabilistic graphical models to represent given problems.
				CO5. Apply sequential data processing algorithms to solve problems.
12.	I	**CSE1114**	**Advanced Algorithm Laboratory**	CO1. Select appropriate algorithm design techniques such as greedy method, dynamic programming, backtracking and heuristic algorithms.
				CO2. Apply backtracking algorithm to solve real world problems.
				CO3. Explore different NP problems and approximation algorithmic solutions.
				CO4. Apply and design parallel algorithms to solve fundamental problems.
				CO5. Apply and compare performance of local search techniques algorithms for solving fundamental combinatorial problems.
				CO6. Compare and design global search techniques for solving engineering/real-world combinatorial problems.
				CO7. Identify the new trends and research directions in algorithms.
13.	I	**CSE1124**	**Program Elective-I Laboratory (Big Data Laboratory)**	CO1. Identify and investigate the distributed underlying experimental bed of Hadoop
				CO2. Compare the attributes of different Hadoop versions and their artifacts
				CO3. Determine the usage of Map-reduce paradigm for parallel execution
				CO4. Recognize the NoSQL prototype to build the big data Imanagement

				CO5. Apply the skills to construct NoSQL designs and its manipulation
14.	I	**CSE1134**	Program Elective-I Laboratory **: (Cloud Computing Laboratory)**	CO1. Configure various virtualization tools such as Virtual Box, VMware workstation.
				CO2. Illustrate the design and development process involved in creating a cloud based application.
				CO3. Design and deploy application in a Aneka PaaS environment.
				CO4. Simulate a cloud environment to implement new schedulers
15.	I	**CSE1144**	Program Elective-I Laboratory**: (Open Source Technology Laboratory)**	CO1. Demonstrate the configuration of software services on servers.
				CO2. Exercise the FOSS tools for the software development.
				CO3. Contribute to existing FOSS in FOSS environment
16.	II	**CSE115**	**Deep Learning**	CO1.Compare Machine Learning and Deep Learning approaches to solve problems; understand usefulness of each one.
				CO2.To get knowledge about introduction to Deep Learning and understand how Deep Learning solves problems which Machine Learning cannot.
				CO3.To implement analyse and evaluate Convolutional networks, RNNs, LSTM, Adam, DroCOut, BatchNorm, vier/He initialization, and more.
				CO4.To apply deep learning concept for different real-time applications.
17.	II	CS**E1164**	**Data Analytics**	CO1.Explore the fundamental concepts of big data and its analytics
				CO2.Analyze the big data using Hadoop and intelligent techniques
				CO3.Investigate big data solutions using Hadoop eco system
				CO4.Identify and formulate various techniques for mining data stream
				CO5.Recognize the suitable secure models for building competitive business decisions
18.	II	**CSE1174**	Program Elective-III**: (Web Application Development)**	CO1.Gain technical competencies in web application development and maintenance.
				CO2.Implement interactive web pages and apply validation checks using client side programming languages like HTML, CSS, Java Script and AngularJS.
				CO3.Process the business data and generate resCOnses dynamically using PHP.
				CO4.Design and develop web services.
				CO5.Use Django Python framework to design interactive web applications
19.	II	**CSE1184**	Program Elective –III: (**Parallel Computing)**	CO1.Explain how massive parallelisms are implemented in accelerator architectures.
				CO2.Design and implement parallel algorithms for GPGPU.
				CO3.Demonstrate parallel patterns for performance improvement.
				CO4.Analyze the parallel programming and computational thinking strategies.
				CO5.Compare different Parallel algorithms from various application domains for performance analysis.

20.	II	**CSE1194**	Program Elective-III **: (Internet of Things)**	CO1. Identify the comCOnents of IoT
				CO2. Design a middleware for IoT
				CO3. Develop IoT application to solve social problems
				CO4. Analyze various protocols for IoT
				CO5. Establish the communication to the cloud through Wi-Fi / Bluetooth
21.	II	**CSE1204**	Program Elective-IV:(**Optimization Techniques)**	CO1.Illustrate the concepts of optimization and its terminologies.
				CO2.Apply and compare the biology-based algorithms.
				CO3.Explore different physics-based algorithms for optimization problems.
				CO4.Design efficient parallel and hybrid algorithms for complex problem solving.
				CO5.Formulate multi-objective optimization problems and categories the multi-objective optimization algorithms.
				CO6.Analyze performance of different algorithms for single and multi-objective mathematical and real-world optimization problems
22.	II	**CSE1214**	Program Elective-IV**:(Cryptology and Network Forensics)**	CO1. Understand OSI security architecture and classic encryption techniques
				CO2. Acquire fundamental knowledge on the concepts of finite fields and number theory
				CO3. Understand various block cipher and stream cipher models
				CO4. Describe the principles of public key cryptosystems, hash functions and digital signature
				CO5. Understand and the principles of network forensics and investigate network frauds
23.	II	CS**E1224**	Program Elective-IV**: (Software Architecture)**	CO1.Recognize major software architectural styles, design patterns, and frameworks
				CO2.Describe a software architecture using various documentation approaches and architectural description languages
				CO3.Design and develop software architecture for large scale software systems
				CO4.Formulate architectural alternatives for a problem and select among them
				CO5.Apply well-understood paradigms for designing new systems
24.	II	**CSE123**	**Deep Learning Laboratory**	CO1. To get knowledge about introduction to Deep Learning and understand how Deep Learning solves problems which Machine Learning cannot.
				CO2 .To acquire knowledge about advanced Machine Learning concept and relevant topics of Linear Algebra and Statistics.
				CO3.To implement analyze and evaluate Convolutional networks, RNNs, LSTM, Adam, DroCOut, BatchNorm, Xavier/He initialization, and more.
				CO4.To apply deep learning concept for different real-time applications.
25.	II	**CSE1244**	**Data Analytics Laboratory**	CO1.Imparting the architectural concepts of Hadoop and introducing map reduce paradigm
				CO2.Introducing Java concepts required for developing map reduce programs
				CO3.Derive business benefit from unstructured data

				CO4.Experimenting programming tools PIG & HIVE in Hadoop echo system
				CO5.Developing Big Data applications for streaming data using Apache Spark
26.	II	**CSE1254**	**Program Elective-III Laboratory: (Web Application Development Laboratory)**	CO1.Gain technical competencies in web application development and maintenance.
				CO2.Implement interactive web pages and apply validation checks using client-side programming languages like HTML, CSS, Java Script and AngularJS.
				CO3.Process the business data and generate resCOnses dynamically using PHP.
				CO4.Design and develop web services.
				CO5.Use Django Python framework to design interactive web applications.
27.	II	**CSE1264**	**Program Elective -III Laboratory:- (Parallel Computing Laboratory)**	CO1.Design different parallel algorithms suitable for multi-core and many-core systems.
				CO2.Implement different parallel algorithms on multi-core and many-core systems.
				CO3.Solve compute intensive problems/develop applications using accelerators.
				CO4.Perform the analysis with different performance metrics.
28.	II	**CSE1274**	**Program elective-III Laboratory: (Internet of Things Laboratory)**	CO1.Identify the comCOnents of IoT
				CO2.Design a middleware for IoT
				CO3.Develop IoT application to solve social problems
				CO4.Analyze various protocols for IoT
				CO5.Establish the communication to the cloud through Wi-Fi / Bluetooth
29.	II	**CSE1284**	**Mini Project**	CO1. Identify and formulate research problem.
				CO2.Identify and implement suitable techniques for research problems.
				CO3.Analyze the results with appropriate tools and techniques available.
				CO4.Present the finding of experimental details and result.
30.	II	**SHP551**	**Technical Communication**	CO1.Acquire skills required for good oral and written communication.
				CO2.Demonstrate improved writing skills and level of readability.
				CO3.Ensure the good quality of technical reCOrts at very first-time submission
31.	III	**CSE2014**	**Industry Internship**	CO1.Acquire sufficient knowledge in respective Industry / advanced IT Technology.
				CO2.Identify problems in the process in industry and provide solution to the same / Implement small demonstrative module using learning got through the professional certification.
32.	III	MOE2010	**Artificial Intelligence - Machine Learning**	CO1.Describe central machine learning methods and techniques and how they relate to artificial intelligence
				CO2.Differentiate between supervised and unsupervised learning techniques
				CO3.Apply the ML algorithms to a real-world problem,
				CO4.Optimize the models learned and reCOrt on the expected accuracy that can be achieved by applying the models.
				CO5.Evaluate a given problem and apply appropriate machine learning technique
33.	III	MOE2020	**Creative Thinking: Tools & Techniques**	CO1.Comprehend imCOrtance in tackling global challenges as well as in everyday problem-solving scenarios
				CO2.Apply different brainstorming techniques in group activities

				CO3.Be proficient in the application of the 6 thinking hats tool in different life scenarios
				CO4.Develop a systematic approach to idea generation through the use of morphological analysis
				CO5.Innovate on an existing product, service or situation applying the SCAMPER method
				CO6.Get confident with the theory of inventive problem solving, called TRIZ
				CO7.Select and apply the appropriate technique based on the opCOrtunity to seize or the problem to tackle
34.	III	MOE2030	**MOOC Course**	CO1.Identify the real application and practices of the courses studied, at the industry level.
				CO2.Recognize various modeling ,analysis and validation techniques adopted at industries.
				CO3.Demonstrate the issue at design, manufacturing and assembly level.
				CO4.Summarize and persent technical data in reCOrt format.
35.	III	MOE2040	**Condition Monitoring and Signal Processing**	CO1.Identify the maintenance scheme, their scope and limitations – apply the maintenance strategies to various problems in the industrial sectors.
				CO2.Analyze for machinery condition monitoring and explain how this compliments monitoring the condition.
				CO3.Develop an appreciation for the need of modern technological approach for plant maintenance to reduce the maintenance expenditure.
				CO4.Emphasizes on case studies that require gathering information using the modern testing equipment and processing it to identify the malfunction in that system.
				CO5.Identify vibration measurement, lubrication oil analysis.
36.	III	MOE2050	**Aircraft Conceptual Design**	CO1. Understand the design process of aircraft and decide the aircraft configuration.
				CO2. Choose type of COwer plant as per flight regime.
				CO3. Decide the fuselage layout as per type of aircraft.
				CO4. Design the wing for type of aircraft and its wing loading.
				CO5. Accurately evaluate lift, drag and mass for design synthesis process.
				CO6. Examine the influence of various design requirements on the configuration of an aircraft to derive an optimized design
37.	III	CSE2034	Dissertation Phase –I	CO1. Identify domain, sub-domain and problem statement for the Study.
				CO2.Perform a literature survey and identify COssible gaps in the existing work in context with identified problem statement.
				CO3.Formulate the problem statement and its objectives of project.
				CO4.Selection of suitable methodology, techniques and dataset for the research work.
				CO5.Write synopsis using standard format with technical aspects and language
38.	III	Course Code **: CSE2044**	Course Name: **Dissertation Phase –II**	CO1.Design and develop bench-marking system which complies expectations and technical specifications mentioned in the Synopsis.
				CO2.Perform experimental observation and analysis of the bench-marking system.
				CO3.Identify gap and proCOse COssible improvements in the implemented bench-marking system.
				CO4.Submit an research article to reputed international conference which should be based on work done till Dissertation Phase 2.

				CO5.Prepare a comprehensive, technically and grammatically correct Dissertation Phase 2 reCOrt describing the work done.
39.	IV	Course Code : **CSE2054**	Course Name: **Dissertation Phase –III**	CO1.Identify research gap or opCOrtunities for novel work in selected problem statement or domain.
				CO2.Define the problem based on identified research gap.
				CO3.Develop algorithm/ methodology to address the identified research gap/ provide solution to the selected problem.
				CO4.Write pseudo code/develop flow-chart/ develop working flow of proCOsed system.
				CO5.Implement the proCOsed approach using required tools.
40.	IV	Course Code : **CSE2064**	Course Name: **Dissertation Phase -IV Viva-Voce**	CO1.Develop / simulate / implement the proCOsed system by complying with desired technical specifications.
				CO2.Compare working and experimental results of the proCOsed system with the existing system.
				CO3.Analyze and synthesize obtained results in theoretical and practical context.
				CO4.Present findings in logical order and write Dissertation ReCOrt on basis of work done, results and observations, findings, and contributions.
				CO5.Submit an research article to reputed international conference which should be based on work done.

Electrical Engineering

- **Department Name :-_Electrical Engineering**
- **UG Program Name :- B. Tech Electrical Engineering**
- **Vision of the Department**: Develop globally competent electrical engineers to serve future needs and challenges of the society

Mission of the Department:

1. To inculcate teaching and learning processes to promote state-of-the-art service in electrical industries to address local and global challenges.
2. To integrate academics, research, and entrepreneurship skills in the domain of electrical engineering to address the present and future challenges of society.
3. To develop professionalism with strong foundations in adapting to changing technology to cater to environmental needs

Sr. No.	Program Outcomes
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2.	**Problem analysis:** Identity, 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 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 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.

Sr. No.	Program Specific Outcomes
1.	Apply knowledge of circuits, machines, power electronics, power systems for the industrial automation and control applications
2.	Operate and control wind power, solar power and electric vehicle systems

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	III	EE2031	DC Machines & Transformer	Co:1 Explain the working principle and operation of single phase and three phse transformer.
				Co:2 Identify various industrial application for single phase and three phase transformer.
				Co3: Describe behavior of dc machines.
				Co4: Interpret characteristics of dc machines.
				Co5: Identify the importance of testing and control of dc machines with suitable industrial applications.
2.	III	EE2051	Electrical Circuit Analysis	Co1: Apply knowledge of mathematics, science, and engineering to the analysis and design of electrical circuits
				Co2: Identify, formulate, and solve engineering problems in the area circuits and systems
				Co3: Coordinate various components and process of electrical system to meet desired needs within realistic constraints
				Co4: Explain importance of various network topology methods for computer analysis of large networks
				Co5: Implement network reduction techniques to solve power system networks
				Co6: Construct and organize various filter for specific circuits
3.	III	EE2071	Analog Electronics	Co1: Explain the fundamentals of solid state electronics including diode, BJT, JFET & MOSFET.
				Co2: Apply DC & AC (small signal) analysis to solid state electronic circuits.
				Co3: Design solid state electronic circuits.
				Co4: Analyze operational amplifier application circuits.
				Co5: Classify power amplifier circuits.

4.	III	EE2091	Power System Economics	Co1: Distinguish conventional and non-conventional energy sources
				Co2: Identify variable load on power stations and factors associated for per unit cost of energy generation.
				Co3: Choose various factors for cost of energy in terms different tariff.
				Co4: Determine different methods of power factor improvement
				Co5: Compare different supply systems used in power system
5.	III	EE2511	DC Machines & Transformers Lab	Co1: Perform various experiments on DC machines
				Co2: Perform various experiments on Transformer.
				Co3: Find out the characteristics of various machines along with their efficiencies
				Co4: Analyze various parameters and predict the durability of the machines
				Co5: Compare the performances of the machines by referring relevant standards
6.	III	EE2531	Electrical Circuits & Simulation Lab	Co1: Analyze responses of electrical circuits in real time
				Co2: Design electrical networks using MATLAB/PSPICE etc.
				Co3: Compare responses of real-time electrical networks with simulations.
				Co4: Explain the importance of the virtual environment to analyze electrical networks
				Co5: Implement various network reduction techniques for power system analysis and modeling
7	III	EE2551	Analog Electronics Lab	Build and analyze electronic circuits as per requirement
				Observe input and output waveform at various test points
				Plot the input & output response of electronic circuits.
				Interpret results of experiment and compare with theoretical values
				Improve the ability to communicate effectively through written lab journals
8	III	SH2091	Engineering Mathematics-III	Solve linear differential equations & problems related to application by using various methods
				Determine expansion of functions by using Fourier series.
				Solve problems on probability distribution by using different formula.
				Determine Laplace transform & inverse Laplace transform of various functions by using properties.
				Laplace transform & apply Laplace transform to solve linear differential equations
				Calculate z- transform & inverse z-transform by using properties of z-

				transform
9	IV	EE2021	Alternating Current Rotating Electrical Machines	Explain different types, construction, working principle & characteristics of three phase induction motors
				Apply the knowledge gained through characteristics of three phase induction motor.
				Explain various types, construction, principle of operation, & application of single phase induction motor
				Describe construction, working principle along with winding details of synchronous generator.
				Analyze performance, characteristics and testing of synchronous machine.
10	IV	EE22041	Power Transmission & Distribution System	Explain structure of power systems
				Analyze various transmission line parameters and its mathematical modelling
				Discover various design aspects of overhead transmission lines
				Explain construction & classification of various underground cables
				Classify various types of A.C and D.C. distribution systems
11	IV	EE2101	Signals and Systems(EE2101)	Classify various signals and systems.
				Analyze linear time invariant systems using different tools.
				Apply time and frequency domain analysis techniques to different signals and systems.
				Evaluate discrete time Fourier transform of a set of well-defined signals.
				Explain the need of signal processing techniques for various engineering fields.
12	IV	EE2061	Electrical and Electronic Measurements	Demonstrate basic concept of calibration, statistical evaluation of measurement data.
				Explain construction & working of various electrical measuring instruments.
				Identify and demonstrate both electrical and electronic measuring instruments.
				Determine R, L, C parameters using AC and DC bridges.
				Explain construction and working of digital instruments
13	IV	EE2081	Digital Electronics	Describe the fundamental concepts and techniques used in digital electronics.
				Formulate the logic expressions using Boolean laws & K-map.
				Design and verify combinational logic circuits
				Design and verify sequential logic circuits.
				Perform various experiments on AC rotating machines.

14	IV	EE2521	A.C. Rotating Electrical Machines Lab	Analyze the characteristics of various ac machines along with their efficiencies.
				Analyze various parameters and predict the durability of the machine.
				Compare the performances of the machines by referring relevant standards.
				Identify proper machine for particular application.
				Study the constructional details of various electrical motors.
15	IV	EE2541	Electrical and Electronic Measurements Lab	Demonstrate calibration of various measuring instruments using statistical evaluation of measurement data.
				Determine power and energy for the given system using various measurement techniques.
				Explain construction and working of various instruments
				Calculate R, L, C parameters using AC and DC bridges..
16	IV	EE2561	Digital Electronics LAB	Verify the truth table of digital electronic components
				Implement desired Boolean functions using digital electronic components
				Design and verify combinational logic circuits.
				Design and verify sequential logic circuits
17	IV	EE2581	Mini Project Environmental Science	Utilize scientific methods to solve environmental problems
				Examine technologies for restoration of degraded environment
				Develop presentation and report writing skills
				Develop as an individual and in group leadership quality.
18	V	EE3031	Power Electronics	Understand the behavior of semiconductor devices operated as power switches.
				Explain operation, waveform and performance parameters of phase controlled converters, uncontrolled rectifiers.
				Analyze and design ac-dc converters
				Explain the basic topologies of dc-dc converters analyze and design dc-dc converters.
				Explain different modulation techniques of pulse width modulated inverters and to understand the harmonic reduction methods. Analyze and design dc-ac inverters.
				Apply the electronic devices for conversion, control and conditioning of power.
	V	EE3071	Feedback Control System	Identify the basic elements and structures and demonstrate an understanding of the fundamentals of

19				feedback control systems.
				Develop the mathematical models of any physical systems such as: state space, transfer function
				Determine the response of different order systems for various standard signals.
				Interpret and analyze time domain systems using virtual environment.
				Interpret and analyze frequency domain systems using virtual environment.
20	V	EE3051	Power System Stability and Control	Analyze symmetrical faults in power systems
				Apply symmetrical components method for fault analysis
				Interpret the necessity of automatic generation control and excitation control.
				Analyze the optimal operation of power system.
				Analyze power system stability.
21	V	EE3091	Microprocessors and Micro controller (EE3091)	Describe the architecture of microprocessor and micro-controller.
				Write assembly language programs for 8085.
				Explain a typical input-output interface.
				Identify instruction addressing modes and syntax for 8051.
				Create an assembly language or C program for 8051 that performs a prescribed task.
				Design and implement a micro-controller-based embedded system.
22	V	EE3011	Electromagnetic Field Theory	Define electric and magnetic fields according to their force effect.
				Understand the physical meanings of the differential equations for electrostatic and magneto static fields
				Calculate the electric field from the stationary charge distributions and magnetic fields from steady current distributions
				Describe and use simple models of electric and magnetic field interactions with materials
				Explain the concept of electromotive force, Maxwell's equations and their physical meanings
				Analyze energy transportation and wave propagation in an electromagnetic field.
23	V	EE3511	Power Electronics Lab	Understand the behavior, turn on & turn off schemes of semiconductor devices operated as power switches.
				Analyze, sketch, examine waveforms, and calculate, measure performance factors of output of ac-to-dc converters.
				Analyze, sketch, examine waveforms, and calculate, measure performance

				factors of output of dc-to-dc converters.
				Analyze, sketch, examine waveforms, and calculate, measure performance factors of output of dc-to-ac inverters.
				Simulate, analyze and design power electronic circuits using MATLAB software.
24	V	EE3531	Feedback Control Systems Lab(EE3531)	Solve the mathematical model of different electromechanical systems
				Model any given electrical, mechanical system with respect to transfer function and state space domain
				Classify appropriate feedback signal, synthesis feedback gains and analyze their results and deduce the first and second order responses.
				Draw the root locus and analyze the system
				Plot the bode, polar and Nyquist plots and analyze frequency domain
25	V	EE3551	Microprocessors and Micro controller Lab(EE3551)	Create a template program, compile it, and then build the executable file.
				Examine the effects of executing many of the 8085 and 8051 instructions by tracing the execution of a program in GNU Simulator and Keil for microprocessor and microcontroller respectively.
				Write their own program in assembly language for 8085 and 8051.
				Write the steps they go through to perform their tasks..
				Apply their programming knowledge (assembly and C) for real time applications.
26	V	SH3191	Scholastic Aptitude I	Develop a thorough conceptual understanding and develop a logical approach towards solving aptitude and reasoning problems
				Understand usage of basic aptitude terms of percentages, averages, ratios and applications of business aptitude terms of profits and interests
				Develop a bridge in analogies, series and visualizing directions
				Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams
27	VI	EE3021	Switch Gear and Protection	Explain different types of protective devices and relay systems.
				Classify circuit breakers and relays
				Suggest suitable protection scheme for a particular power system component
				Discuss under voltage and overvoltage protection scheme
				Design a protection scheme for power system

28	VI	EE3041	Control System Design	Design and tune proportional, integral and derivative controllers for given specifications
				Design a suitable compensator using root-locus technique for the given specifications
				Design a suitable compensator in frequency domain for the given specifications
				Design state feedback controller and observer for given system
				Construct MATLAB models for the implementation of closed-loop systems.
29	VI	EE3101	Restructured Power System	Explain restructuring of power system and related fundamentals of economics
				Analyze role of independent system operator in deregulated power system
				Analyze transmission congestion management and ancillary services in deregulated power system
				Explain Indian electricity act in context with deregulated power market
				Compare different organizations in Indian power sector in view of Indian electricity grid.
30	VI	EE3081	Electrical Drives and Control	Analyze stability, moment of inertia, speed and torque in drive systems
				Compare various control strategies for electrical drive systems
				Discuss starting, braking and speed control for AC and DC drives.
				Explain vector control of induction motor drives.
				Explain the speed control of synchronous motor and special motor drives.
31	VI	EE3541	Switchgear and Protection Lab	Identify different switches and circuit breakers
				Observe and explain MCCB.
				Plot characteristics of Relays.
				Assure working of Relays based on their technology and characteristics.
				Discuss different protection schemes.
				Demonstrate for Transformer and Generator protection
32	VI	EE3561	Electrical Drives and Control Lab	Demonstrate AC and DC drives fed from various power electronics converter.
				Examine closed loop control of electrical drive systems.
				Analyze performance of electrical drives by plotting speed-torque characteristics.
				Compare performance of electrical drive systems according to speed-torque characteristics.
				Simulate AC and DC drives fed from various power electronic converters.

33	VI	EE3521	Control System Design Lab	Design and implement PID controller for a closed-loop system
				Design a suitable compensator using root-locus technique.
				Design a suitable compensator in frequency domain.
				Develop state feedback controller and observer for SISO system.
				Demonstrate control of closed-loop systems using MATLAB.
34	VI	EE3061	Instrumentation Techniques	Describe basic concepts of instrumentation and characteristics of instruments.
				Explain selection factors and application of transducers and sensors.
				Discuss different types of signal conditioning devices
				Explain different data conversion techniques and digital instruments
				Describe different type of industrial process controllers
35	VI	SH3222	Scholastic Aptitude	Develop a thorough conceptual understanding and develop a logical approach towards
				Solving aptitude and reasoning problems
				Understand usage of aptitude terms of speed, time and distance and permutations, probabilities and applications.
				Understand blood relations and ways of seating arrangements along with various geometrical figures
				Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams
36	VII	EE4021	Industrial organization and management	Apply the industrial management concepts, financial management concepts
				Contribute to the development, implementation, and evaluation of employee recruitment, selection, and retention plans and processes.
				Explain the importance of materials management function in an organization, and how it can help in integrating various plans and reduce the material related costs
				Design a marketing research study that will act as a key resource in the development of a marketing plan
				Explain industrial psychology and solve the industrial problems.
				Describe the need of industrial automation and their functions.
				Make use of standard IEC programming languages.
				Design relay/RLL based control logic

37	VII	EE4041	Automation and Control(EE4041)	for Boolean expressions.
				Construct relay logic ladder diagram for the given application.
				Develop GUI for monitoring system of the given real time applications using SCADA/HML.
38	VII	EE4081	Power System Planning	Explain the need of power system expansion
				Analyze the given power system for determining optimal values of decision variables.
				Apply mathematical tools to solve multi-objective optimization problems in expansion planning and reliability studies.
				Explain long term and short term planning.
				Discuss various economic analysis methods.
39	VII	EE4031	Electrical Machine Design	Calculate MMF and thermal rating of various types of electrical machines
				Design armature and field systems for DC machines
				Design core, yoke, windings and cooling systems of transformers.
				Design stator and rotor of induction machines.
				Design stator and rotor of synchronous machines and study their thermal behavior.
40	VII	EE4071	FACTS and HVDC	Understand the importance of controllable parameters and benefits of facts controllers.
				Analyze the functional operation and control of series and shunt compensation.
				Describe the principles, operation and control of multi-functional facts controller.
				Identify significance of DC over AC transmission system, types and application of HVDC links in practical power systems.
				Apply various methods of grid control for HVDC systems.
41	VII	EE4521	Automation and Control Lab	Design relay logic control system for given application using relays.
				Develop RLL for Boolean expressions.
				Develop RLL using timer and counter instructions.
				Develop RLL using math instructions.
				Develop GUI using SCADA/HMI for given application
42	VII	EE4531	Electrical Machine Design lab	Calculate design parameters of an electric machine
				Analyze the effect of calculated design parameters electrical machines

				Design electrical machine using design software
43	VII	EE4571	Industry In-plant Training	To acquire and apply fundamental principles of engineering.
				Become updated with all the latest changes in technological world
				Develop ability to communicate efficiently
				Improve ability to identify, formulate and model problems and find engineering solution based on a systems approach
				Develop awareness of the social, cultural, global and environmental responsibility as an engineer
44	VII	RE0407	Research UROP Phase I	Perform literature review and identify research topic.
				Write synopsis of the research work that being done in semester.
				Write technical review paper.
45	VII	LL007	Liberal Learning IIP	Identify the liberal learning online course from the NPTEL platform
				Describe the online course given by the institute
				Apply the concept understand through the course in day to day life
46	VII	ED4001	Business Opportunity Guidance	Generate & identify different business ideas.
				Make analysis of different ideas.
				Select proper business idea to suit his personality & competencies.
47	VII	EE4101	Advanced Power Electronics	Apply knowledge of modern power electronics converters and its application in modern power electronics
				Compute mathematical model of converter
				Solve the state space model for power converters
				Analyze resonant converters and their topologies
				Analyze the operation of power converters, filters, ups systems
48	VII	EE4051	Computer Modelling of Electrical Power System	Develop mathematical models of various equipment used in power system to analyses both AC and AC-DC power system network.
				Model single and three phase power system network components by using linear transformation and compound admittance technique.
				Formulate AC and AC-DC power system analysis problem.
				Apply various methods of load flow studies to analyze AC power system network.
				Analyze AC-DC power system network by using power flow analysis method
	VIII	EE4061		Identify and assess the energy

49			Energy Audit and Management	conservation/saving opportunities in different electric system
				Identify and assess energy conservation opportunities in thermal system
				Demonstrate skills required for energy audit and management
				Prepare energy flow diagrams and energy audit report
				Suggest cost-effective measures towards improving energy efficient and energy conservation.
50	VIII	EE4121	Digital Control System	Apply z transform techniques to model systems
				Realize the digital PID controller
				Analyze the systems in s-plane and z-plane
				Determine state-space representation of dynamical systems using linear algebra
				Design the controller using pole placement technique and optimal control
51	VIII	OE432	Wind Energy Engineering	Apply fundamental principles of thermodynamics, fluid mechanics and mechanical systems to wind turbine engineering.
				Calculate various parameters related to wind turbine.
				Design of wind turbine components.
				Design in virtual environment.
				Work on team-based projects.
52	VIII	EE4511	Advanced Power Electronics Laboratory	Evaluate different DC-DC regulators
				Simulate and analyze resonant converters
				Select appropriate phase shifting converter for multiphase converter
				Evaluate various multi-level inverter configuration
				Compare various facts devices for VAR compensation
53	VIII	EE4531N	Computer Modelling of Electrical Power System Lab	Develop admittance matrix for the given power system network by using linear transformation technique and inspection method
				Analyzing HVDC conversion plant by simulating power electronic conversion system.
				Apply various power flow analysis method to solve AC and AC-DC power system network.
				Develop MATLAB program to solve the defined power system problem.
				Use various application software packages to perform power flow study of given power system network.
				Devise sound technical knowledge, for identified problem of project

54	VIII	EE4541A	Project Phase II	Propose engineering solution to complex problems.
				Demonstrate the skills and attitude in professional way in a team
				Illustrate the component and cost optimization solutions wherever applicable
				Develop skills towards the use of modern tools and presentations
				Justify outcomes through simulation/ experimentation in environmental and sustainable way
				Summarize project report in an ethical way

- **Department Name: Electrical Engineering**
- **PG Program Name: Power Systems and Power Electronics**
- **Vision:** Develop globally competent electrical engineers to serve future needs and challenges of the society
- **Mission:** To impart technical education and research skills in close interaction with industry and society for the development of young minds, sensitive to ethical and environmental issues.

Sr. No.	Program Outcomes
1.	To independently carry out research /investigation and development work to solve practical problems.
2.	To write and present a substantial technical report/document.
3.	To demonstrate a degree of mastery over the area of power systems and power electronics.
4.	To collaborate, work harmoniously in teams and address multidisciplinary issues with consideration of professional, legal, and ethical concerns.
5.	To use advanced techniques, skills, and modern engineering tools with financial aspects.
6.	To learn continuously, independently and update knowledge & skills

Sr. No.	Program Specific Outcomes
3.	Demonstrate skills in the area of power systems and power electronics for industrial applications.
4.	Investigate and conduct research in the area of power & energy systems and electric mobility

Sr. No.	Semester	Course Code	Course Name	Course Outcome (CO)
1.	I	SHP5151	**Numerical Computational Technique**	1. Estimate the error.
				2. Apply the relevant numerical method for interpolating the polynomial
				3. Develop the equation to be fitted and fit the curve for given data
				4. Estimate numerically the solution of given algebraic equation.
				5. Use the relevant method for solving the simultaneous linear equations and compute the Eigen values.
				6. Construct the fuzzy set for given linguistic variable and apply fuzzy logic.
2.	I	EPP1011	**Computer aided Power System Analysis**	1. Model different components of power system
				2. Carry out contingency analysis of power system
				3. Analyze power network by conducting power flow studies
				4. Model and simulate generator excitation system
				5. Estimate state of power system using state estimation theory
3	I	EPP1021	**Electric and Hybrid Electric Vehicles**	1. Discuss the trends and philosophy of electric vehicles
				2. Analyze Conventional Vehicles and Powertrains
				3. Discuss the electric drive mechanism.
				4. Classify hybrid electric vehicles
				5. Differentiate Electric and range-extended electric vehicles
				6. Describe plug-in hybrid electric vehicles and electrical infrastructure
4	I	EPP1031	**Wind and Solar energy Technology**	1. Describe the principle of energy generation from wind and solar PV systems
				2. Formulate wind and solar energy systems by mathematical equations

Sr. No.	Semester	Course Code	Course Name	Course Outcome (CO)
				3. Assess energy produced from wind and solar energy systems.
				4. Compare the different methods of energy generation from wind and energy systems
				5. Develop economic analysis of a wind turbine and solar PV systems
5	I	EPP1041	**Advanced Power Electronics Systems**	1. Classify different type's converters with respect to power output, configuration and application.
				2. Compare different types of power converters
				3. Describe the working principle of different types of power converters
				4. Model different types of power converters mathematically.
				5. Design pore converter for specific application.
6	I	EPP1051	**Distribution Automation**	1. Prepare layout of the substations and feeders considering load and desired voltage
				2. Design distribution system and associated equipment and devices.
				3. Identify an appropriate method of communication for any particular distribution system with a view of automation and SCADA
				4. Analysis distribution feeder components.
				5. Model the different distribution feeder components.
7	I	EPP1061	**HVDC Transmission**	1. Justify the need of HVDC Transmission system for power transmission
				2. Analyze different working modes of converters used for HVDC transmission
				3. Compare different control schemes employed for controlling HVDC system
				4. Compute the filter parameters for elimination of voltage and current harmonics in HVDC system
				5. Draw and compare different configuration multi-terminal HVDC system
8	I	EPP1071	**Power Electronics Application to Power Systems**	1. Justify need of reactive power compensation schemes
				2. Classify different power electronics based reactive power compensation systems
				3. Identify suitable reactive power compensation system for specific power system problems.
				4. Compare performance of different power electronics based reactive power compensation systems
				5. Design suitable power electronic based reactive power compensation system for specific power system problem
9	I	EPP1081	**Smart Grid Technologies**	1. Discuss the smart grid in Indian perspective
				2. Explain various smart grid technologies.
				3. Describe smart meters and advance metering infrastructure.
				4. Compare Smart grid and microgrid
				5. Apply power quality management in smart grid
				6. Identify communication technologies for smart grid
10	I	EPP1091	**Power System Steady State Analysis Lab**	1. Develop script to analyze symmetrical components using power system software.
				2. Analyze load flow and fault studies of given power system network using power system software.

Sr. No.	Semester	Course Code	Course Name	Course Outcome (CO)
				3. Develop program for power system optimization problem
				4. Develop estimation algorithm using least square methods.
				5. Use various power system software packages to analyze power system networks
11	I	EPP1101	**Renewable Energy Lab**	1. Prepare report on wind resource assessment
				2. Operate and maintain squirrel cage and DFIG based systems.
				3. Compute reactive power requirement for standalone wind turbine system
				4. Demonstrate the effects of shadowing on PV modules
				5. List the installation materials for off grid PV systems
12	II	EPP2011	**Power System Dynamics and Stability**	1. Describe power system operating states and control
				2. Analyze synchronous machine models
				3. Model excitation and prime mover system
				4. Describe the power system stability
13	II	EPP2021	**Advanced Control of Electrical Drives**	1. Justify the need of closed loop drive system for industrial applications.
				2. Explain the working principle of different types of drive system.
				3. Compare different types of electric drives.
				4. Develop mathematical models of electric drive system for specific application.
				5. Design controllers for closed-loop operation of different types of electrical motors.
14	II	EPP2031	**Grid Integration of Renewable Energy Sources**	1. Summarize the grid codes for integration of renewable energy sources
				2. Explain the working principle of different power electronic topologies and controllers.
				3. Model mathematically renewable energy sources and associated control system
				4. Design systems to reduce impact of renewable energy fluctuations on grid
				5. Develop simulation systems using MATLAB
15	II	EPP2041	**Digital Protection of Power System**	1. Discuss the importance of power electronics devices in power system protection.
				2. Distinguish between conventional relays and modern relays
				3. Apply mathematical approach towards protection
				4. Develop algorithms for numerical protection
				5. Explore recent advances in digital protection of power systems
16	II	EPP2051	**Power System Optimization**	1. Explain the need of power system optimization
				2. Formulate power system optimization problem
				3. Apply numerical and heuristic technique to solve power system optimization problem.
				4. Solve power system optimization problem
				5. Assess the impact of parameters on defined optimization problem.
17	II	EPP2061	**Power System Restructuring**	1. Describe the new dimensions associated with the power systems.
				2. Determine transmission congestion management
				3. Discuss pricing of transmission network

Sr. No.	Semester	Course Code	Course Name	Course Outcome (CO)
				4. Explain ancillary service management in electrical market
				5. Justify the role and functions of PX, IEX and various organization in Indian restructured power market
18	II	EPP2071	**Power Quality and Harmonics**	1. Discuss various power quality problems and their analysis.
				2. Classify various voltage quality issues and solutions.
				3. Describe Power Quality Standards and Monitoring.
				4. Asses sources of harmonic in power system
				5. Analyze effects of Harmonics on Power system
				6. Design of harmonic filters.
19	II	EPP2081	**Electrical Energy Storage Systems**	1. Discuss the energy storage as a structural unit of a power system.
				2. Compare various energy storage technologies for power systems.
				3. Apply battery energy storage and management for power system.
				4. Describe hydrogen energy storage for power system.
				5. Discuss short-term, mid-term and long-term applications of power system.
				6. Analyze economics and reliability of energy storage Systems
20	II	EPP2091	**Research Methodology & IPR**	1. Formulate a research problem.
				2. Analyze research related information
				3. Prepare and present research proposal/paper by following research ethics
				4. Make effective use of computers and computing tools to search information, analyze information and prepare report.
				5. Describe nature and processes involved in development of intellectual property rights
21	II	EPP2101	**Advanced Power System Protection Lab**	1. Analyze characteristics of digital relays
				2. Demonstrate fault simulation on different protection panels
				3. Develop an algorithm for different protection schemes
				4. Simulate protection models
				5. Interpret the simulation results
22	II	EPP2111	**Advanced Drives Lab**	1. Demonstrate control of Induction motor drive.
				2. Experiment with chopper fed DC drive system.
				3. Experiment with three phase half and full converter fed DC motor drive.
				4. Demonstrate control of BLDC, servo and stepper motor drive system.
				5. Demonstrate control of AC and DC drives using MATLAB/SIMULINK
23	II	SHP551	**Technical Communication**	1. Acquire skills required for good oral and written communication
				2. Demonstrate improved writing and reading skills
				3. Ensure the good quality of oral and written communication
24	II	EPP2121	**Mini Project**	1. Formulate a real-world problem.
				2. Design solution for a set of requirements.
				3. Use software packages available to analyze the proposed theory.

Sr. No.	Semester	Course Code	Course Name	Course Outcome (CO)
				4. Explain technical ideas, strategies and methodologies in written form and oral presentations
25	III	EPP3010	**Industry Internship**	1. Apply engineering knowledge learned during the program.
				2. Apply his/her technical skills to solve industrial problem.
				3. Work in multi-disciplinary environment.
26	III	MOE2010	**Artificial Intelligence - Machine Learning**	1. Describe central machine learning methods and techniques and how they relate to artificial intelligence
				2. Differentiate between supervised and unsupervised learning techniques
				3. Apply the ML algorithms to a real-world problem,
				4. Optimize the models learned and report on the expected accuracy that can be achieved by applying the models.
				5. Evaluate a given problem and apply appropriate machine learning technique
27	III	MOE2020	**Creative Thinking: Tools & Techniques**	1. Comprehend importance in tackling global challenges as well as in everyday problem- solving scenarios
				2. Apply different brainstorming techniques in group activities
				3. Be proficient in the application of the 6 thinking hats tool in different life scenarios
				4. Develop a systematic approach to idea generation through the use of morphological analysis
				5. Innovate on an existing product, service or situation applying the SCAMPER method
				6. Get confident with the theory of inventive problem solving, called TRIZ
				7. Select and apply the appropriate technique based on the opportunity to seize or the problem to tackle
28	III	MOE2030	**MOOC Course**	1. Identify the real applications and practices of courses studied, at industry level
				2. Recognize various modeling, analysis and validation techniques adopted at industries.
				3. Demonstrate the issues at design, manufacturing and assembly levels.
				4. Summarize and present technical data in report format.
29	III	MOE2040	**Condition Monitoring and Signal Processing**	1. Identify the maintenance scheme, their scope and limitations – apply the maintenance strategies to various problems in the industrial sectors.
				2. Analyze for machinery condition monitoring and explain how this compliment monitoring the condition.
				3. Develop an appreciation for the need of modern technological approach for plant maintenance to reduce the maintenance expenditure.
				4. Emphasizes on case studies that require gathering information using the modern testing equipment and processing it to identify the malfunction in that system.
				5. Identify vibration measurement, lubrication oil analysis.

Sr. No.	Semester	Course Code	Course Name	Course Outcome (CO)
30	III	MOE2050	**Aircraft Conceptual Design**	1. Understand the design process of aircraft and decide the aircraft configuration.
				2. Choose type of power plant as per flight regime.
				3. Decide the fuselage layout as per type of aircraft.
				4. Design the wing for type of aircraft and its wing loading.
				5. Accurately evaluate lift, drag and mass for design synthesis process.
				6. Examine the influence of various design requirements on the configuration of an aircraft to derive an optimized design.
31	III	EPP3031	**Dissertation Phase - I**	1. Identify research opportunities in his/her domain or multidisciplinary domains
				2. Formulate the problem statement and its objectives correctly
				3. Apply the principles of project management during development of the project
				4. Present synopsis in logical order
				5. Write synopsis of the proposed system
32	III	EPP3041	**Dissertation Phase - II**	1. Identify research opportunities in his/her domain or multidisciplinary domains.
				2. Formulate the problem statement and its objectives correctly
				3. Develop, simulate and implement the system by complying with desired technical specifications
				4. Analyze and synthesize obtained results in theoretical and practical context
				5. Present report in logical order
				6. Write report of the system implementation
33	IV	EPP4011	**Dissertation Phase - III**	1. Formulate the problem statement and its objectives correctly
				2. Develop, simulate and implement the system by complying with desired technical specifications
				3. Analyze and synthesize obtained results in theoretical and practical context
				4. Present report in logical order
				5. Write report of the system implementation
				6. Apply the principles of project management during development of the project
34	IV	EPP4021	**Dissertation Stage IV**	1. Formulate the problem statement and its objectives correctly
				2. Develop, simulate and implement the system by complying with desired technical specifications
				3. Analyze and synthesize obtained results in theoretical and practical context
				4. Present report in logical order
				5. Write report of the system implementation
				6. Apply the principles of project management during development of the project

Electronics & Telecommunication Engineering

- **Department Name: -** Electronics & Telecommunication Engineering
- **UG Program Name: -** Electronics & Telecommunication Engineering
- **Vision and Mission: -**

Vision: - Promote excellence in the field of Electronics & Telecommunication Engineering and allied areas through quality education

Mission: -

- To provide quality education through need based curriculum, effective teaching learning process and state-of-art infrastructure.
- To inculcate research aptitude leading to patents and publications in refereed journals.
- To imbibe professional ethics, leadership skills, social, cultural & environmental awareness with a passion for lifelong learning.
- To strengthen relationships with industry, society, government bodies and alumni.

Sr. No.	Program Outcomes
1.	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
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

Sr. No.	Program Specific Outcomes
1.	Analyze, design and develop electronic systems for communication applications by using appropriate modern tools and techniques
2.	Demonstrate the knowledge of the state of art tools and apply for the development of VLSI circuits/systems

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	III	H2113	Engineering Mathematics –III	Apply various transformation techniques to solve engineering problems
				Solve linear differential equations & problems related to engineering application in electronics
				Determine expansion of functions by using Fourier series
				Apply the statistical techniques to solve various problems
2.	III	EC2013	Electronic Devices	Describe fundamentals of semiconductor devices.
				Explain working principle of various solid state devices
				Illustrate various applications of electronic devices.
				Interpret results of various electronic circuits
				Analyze different biasing circuits, frequency models
3.	III	EC2033	Digital System Design	State fundamental knowledge of digital design
				Apply knowledge for real-time application
				3. Illustrate combinational and sequential circuits
				Design combinational and sequential circuits
4.	III	EC2053	Analog Communication	Describe concepts in analog communication system
				Solve numerical based on various communication systems
				Analyze different modulation and demodulation techniques
				Compare the performance of modulation techniques
5.	III	EC2073	Network Theory	Apply circuit analysis techniques to simplify dc and ac circuits.
				Analyze steady state and transient responses of the networks.
				Determine parameters, functions and stability of the networks.

				Design circuits for the given requirements
6.	III	EC2093	Electronic Devices Lab	Sketch and analyze electronic circuits as per requirement
				conduct an experiment to observe response
				calculate different parameters from experimental results and plot the response
				interpret results of experiment and compare with measured values
				improve the ability to communicate effectively through written lab journals
7.	III	EC2113	Digital System Design Lab	Apply Boolean laws and k-map to design digital circuits.
				Demonstrate the operation of combinational and sequential circuits for various practical applications.
				Interpret results and compare with experimental values.
				Communicate effectively through lab journals
8.	III	EC2133	Analog Communication Lab	Build different analog communication system
				Demonstrate different modulation and demodulation methods
				Develop different communication system using software tools
				Conduct experiments in group and write reports
9.	III	EC2153	Technical Aptitude-I	Choose proper techniques to find solution for engineering problems
				Solve various types of problems
				Develop ability to face competitive examinations
				Inspect the problem & conclude with proper solution
10.	III	SH2633	Professional Leadership Skills	Explain the traits of a leadership through real life examples
				Exhibit the ability to work effectively in team
				Prepare a presentation as per the audience and context requirements
11.	III	SH2613	Interpersonal Skills (‘Jeevanvidya’ for Work life Balance)	Exhibit interpersonal communication skills
				Demonstrate decision-making skills
				Apply conflict resolution styles appropriate in different situations

				Demonstrate skills to manage balance in work and life
				Apply Jeevanvidya wisdom in day life
12.	III	SH2693	Innovation Tools and Methods for Entrepreneurs	Explain structured approach to define the problem with every possible details, identify conflicts and solve them
				Apply User Journey Map to the selected problem to show user interaction at various stages
				Analyze the solutions provided by competitors for effectiveness and gaps if any
13.	III	SH2593	Personal Effectiveness and Body Language	Develop skills to build self-esteem, and positive attitude
				Develop interpersonal skills characterized by effective communication and conflict resolution
				Discover ways to overcome procrastination
				Demonstrate responsiveness towards stress and health issues
				Interpret the non-verbal behavior of a person
14.	III	SH2733	German Language- Basic Level	Interpret the language if the next person is speaking slowly and clearly
				Make use of the language in routine life with routing topics like family, shopping, work etc.
				Demonstrate the language by self-introduction in German with simple sentences
15.	III	SH2712	Japanese Language- Level III	Make use of basic conversations in various situations
				Identify the sentence patterns
				Explain insight about the communication required for living in Japan
				Interpret Japanese work ethics required in their professional career
16.	IV	CE2263	Engineering Mechanics	Classify various forces and their effects, to analyze real life problems.
				Analyze engineering problems applying conditions of equilibrium.
				Determine Centroid & Moment of Inertia of the geometrical plane lamina
				Apply fundamental concepts of Kinematics and Kinetics to analyze practical problems.

17.	IV	EC202	Linear Integrated Circuit and Applications	Analyze different parameters of various configurations of operational amplifier
				Design different applications of operational amplifier
				Classify various oscillators and active filters
				Illustrate different applications of operational amplifier and special ICs
18.	IV	EC2043	Microcontroller	Describe basic fundamentals of PIC microcontroller
				Write programs for PIC microcontroller
				Interface peripheral with PIC microcontroller
				Develop an embedded application using PIC microcontroller
19.	IV	EC2063	Digital Communication	Explain different concepts of digital communication systems.
				Calculate various parameters on statistical theory, source coding and channel coding.
				Apply various theorems of encoding and error control on signals.
				Analyze various digital modulation and channel coding techniques
20.	IV	EC2083	Signals and Systems	Classify continuous and discrete time signals and systems.
				Illustrate use of convolution and impulse response in LTI systems.
				Apply mathematical techniques to manipulate signals and systems.
				Make use of transform theory techniques for system analysis in time and frequency domain
21.	IV	SH2173	Environmental Science	Discuss the importance and sensitivity of environment**.**
				Interpret the over exploitation of natural resources and follow the environmental ethics.
				Explain methods to protect environment and prevent environmental pollution.
				Apply their knowledge and skills to solve environment related problems
22.	IV	CE2283	Engineering Mechanics Lab	Compare coefficient of friction of various surfaces in contact.
				Correlate theoretical and practical results of support reactions and Centroid of plane lamina.
				Verify law of polygon of forces, law of triangle of forces and principle of moment.
23.	IV	EC210	Linear Integrated Circuit and Applications Lab	Design different applications of integrated circuits

				Implement application circuits
				Interpret theoretical and practical results
				Communicate effectively through lab journals
24.	IV	EC2142	Microcontrollers Lab	Install configure and utilize the MPLAB tools for PIC microcontroller programming
				Write programs for PIC Microcontroller
				Compile debug and test programs for PIC microcontroller
				Develop application using PIC microcontroller
25.	IV	EC2143	Digital Communication Lab	Write MATLAB code for given specifications
				Demonstrate different digital communication techniques.
				3. Analyze the results by comparing with interpreted values
				Communicate effectively through lab write-ups
26.	IV	SH 2603	Environmental Science project	Utilize scientific methods to solve environmental problems.
				Evaluate technologies for restoration of degraded environment.
				Develop presentation and report writing skills.
				Develop as an individual and in group leadership quality
27.	IV	EC215	Technical Aptitude-II	Choose proper techniques to find solution for engineering problems
				Solve various types of problems
				Develop ability to face competitive examinations
				Inspect the problem & conclude with proper solution
28.	IV	SH2593	Personal Effectiveness & Body Language	Develop skills to build self-esteem and positive attitude.
				2. Develop interpersonal skills characterized by effective communication and conflict resolution.
				3. Discover ways to overcome procrastination.
				4. Demonstrate responsiveness towards stress and health issues.
				5. Interpret the non-verbal behavior of a person
30	IV	SH2613	Interpersonal Skills (‘Jeevanvidya’ for Work life Balance)	Exhibit interpersonal communication skills.
				2. Demonstrate decision-making skills.
				3. Apply conflict resolution styles appropriate in different situations.
				4. Demonstrate skills to manage balance in work and life.

				5. Apply Jeevanvidya wisdom in day to day life
31	IV	SH2633	Professional Leadership Skills	1. Explain the traits of a leadership through real life examples.
				2. Exhibit the ability to work effectively in team.
				3. Prepare a presentation as per the audience and context requirements.
32	IV	SH2693	Innovation Tools and Methods for Entrepreneurs	Explain structured approach to define the problem with every possible detail, identify conflicts and solve them
				Apply User Journey Map to the selected problem to show user interaction at various stages
				Analyze the solutions provided by competitors for effectiveness and gaps if any
33	IV	SH2643	German Language-Advanced Level	Interpret the language if the next person is speaking slowly and clearly.
				Make use of the language in routine life with the routing topics like family, shopping, work etc.
				Demonstrate the language by self-introduction in German with simple sentences
34	IV	SH2623	Japanese Language-Advanced Level	To be able to make basic conversations in various situations.
				To recognize the sentence patterns.
				To improve Japanese Language proficiency.
				To give students insights about the communication required for living in Japan.
				5)To expose students to the Japanese work ethics required in their professional careers
35	V	EC3012	Digital Signal Processing	Apply basic techniques of signals and system for implementation of digital signal processing system.
				Describe techniques available for implementation of digital signal processing system.
				Explain techniques available for implementation of digital signal processing system.
				Design and simulate the working of given digital signal processing system.
				Realize the given digital signal processing system
36.	V	EC3032	Power Electronics	Discuss characteristics, ratings and drive circuits of the power devices.
				Analyze the operation of power electronics converters, inverters and drives.
				Determine performance parameters of the converters and inverters.

				Design switching control circuit to meet desired specifications
37.	V	EC3052	Product Design	Describe the stages of product design and development
				Apply various concepts for product design.
				Devise product testing methods.
				Explain the processes and importance of documentation
38.	V	EC3072	Electromagnetic Waves & antenna Theory	Apply the knowledge of vector algebra and co-ordinate system to formulate and solve electromagnetic field problems.
				Use and apply basics of electric and magnetic fields to solve the electrostatics and magneto-statics problems.
				Solve transmission line and Wave propagation problems.
				Explain basics of antennas
39.	V	EC3092	Information Theory and Coding	Explain different concepts in information theory and coding.
				Solve numerical on information theory, source coding and channel coding and error control coding.
				Apply various theorems of encoding, error control etc. on signals.
				Analyse various channel coding and error control techniques
40.	V	EC3112	Mixed Mode Controller	Explain the basic concepts of MSP430.
				Write Assembly and C programs for MSP430
				Interface Peripherals with MSP430
				Design low power Embedded system using MSP430
41.	V	EC3132	Audio Video Engineering	Design and construct the audio-amplifier with various controls.
				Analyze comprehensive of television systems.
				Select television standards.
				Differentiate different television receivers.
				Summarize consumer Applications
42.	V	EC3152	RTL Simulation and Synthesis with PLDs	Describe fundamentals of HDL
				Convert combinational and sequential modules into RTL form
				Choose proper coding technique to solve problems
				Design and synthesize various digital modules
43.	V	EC3172	Control System	Identify the mathematical models of different type of the control systems.
				Design and analyze the system parameters to meet performance

				specifications in time and frequency domain.
				Comment about stability of control system.
				Distinguish different control system and compensators
44.	V	EC3192	Comprehensive Exam - III	Choose proper techniques to find solution for engineering problems
				Solve various types of problems
				Develop critical thinking and reasoning skills
				Develop ability to face competitive examinations
				Inspect the problem & conclude with proper solution
45.	V	EC3212	Digital Signal Processing Lab using MATLAB	Design and simulate the working of given digital signal processing techniques
				Evaluate the performance of designed digital signal processing system
				Write relevant conclusion on the performance of designed digital signal processing system
				Present and write laboratory reports in desired format in grammatically correct language
46.	V	EC3232	Power Electronics Lab	Interpret V-I characteristics of power electronics devices
				Experiment power electronics converter for various conditions
				Design and analyze power electronic converter
				Create documentation report of the experiment
47.	V	EC3252	Object Oriented Programming using C++ Lab	Write, debug, and test basic C++ codes using the object oriented approaches introduced in the course.
				Discuss and analyze C++ problems in an object-oriented programming tool.
				Evaluate the performance of developed C++ program.
				Present and write laboratory reports in desired format in grammatically correct language
48.	V	EC3272	Antenna Lab	Measure and analyze the parameters of the different antennas
				Design and Simulate different types of Antennas using Electromagnetic Field solver
				Analyze the performance of the different types of antennas
				Demonstrate ability to work effectively in a team

49.	V	SH3032	Aptitude Training I	Develop a thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning problems.
				Understand usage of basic aptitude terms of percentages, averages, ratios and applications of business aptitude terms of profits and interests
				Develop a bridge in analogies, series and visualizing directions.
				Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams.
50.	V	EC3292	Summer Internship (4 Weeks)	Demonstrate skills to use modern engineering tools, software, and equipment to solve real world problems.
				Apply knowledge of professional and ethical responsibilities.
				Communicate in verbal and written form.
				Write a detailed report on Summer Internship
51.	V	SH301	Indian Constitution	Create awareness about law depiction and importance of Constitution
				Define Fundamental Rights and Fundamental Duties of the Indian Citizen to instill morality, social values, honesty, dignity of life and their social Responsibilities.
				Create Awareness of their Surroundings, Society, Social problems and their suitable solutions while keeping rights and duties of the citizen keeping in mind.
				Recognize distribution of powers and functions of Local Self Government.
				Comprehend the National Emergency, Financial Emergency and their impact on Economy of the country
52.	VI	EC3022	CMOS VLSI Design	Describe fundamentals of MOS circuits
				Apply knowledge of MOS circuits and fabrication process to solve problems
				Analyze combinational and sequential MOS VLSI circuits
				Design various digital modules using MOS technology
53.	VI	EC3042	Robotics	Describe robot mechanism with necessary hardware and software
				Design and control robot mechanism
				Analyze interfacing between Fire Bird V Robot with different wired and wireless communication modules

				Describe robot mechanism with necessary hardware and software
54.	VI	EC3062	Artificial Intelligence	Describe fundamentals of artificial intelligence
				Explain various algorithms in machine and deep learning
				Analyze different architectures and basic techniques used in AI
				Apply mathematical models and algorithms to solve real-world problems
				Design and implementation issues in various AI applications
55.	VI	EC3082	Scientific Computing	Describe the significance of computing methods
				Apply method strengths in the application areas
				Perform the computations on various data using appropriate computation tools
56.	VI	EC3102	MEMS	Describe MEMS material and fabrication techniques.
				Discuss various sensors and actuators used in MEMS.
				Analyze various applications of MEMS to disciplines beyond Electrical and Mechanical
57.	VI	EC3122	Wavelets	Design filter banks
				Analyze filter banks and wavelets
				Apply wavelets for engineering and scientific applications
58.	VI	EC3142	Nano Electronics	Describe basic and advanced concepts of nanoelectronic devices.
				Illustrate different application of nanoelectronics.
				Interpret the results of various applications
59.	VI	EC3162	Automotive Electronics	Draw section blocks of automotive electronics systems.
				2. Interpret components of automotive electronics system.
				3. Develop microcontroller based automotive electronics system
				4. Examine safety and comfort features of automobile
60.	VI	OE3142	Mechatronics	Explain mechatronics system
				Identify electrical, hydraulic and pneumatic components
				Analyze the mechatronics based system

61.	VI	SH302	Biology for Engineers	Apply biological engineering principles, procedures needed to solve real-world problems
				Demonstrate the functions of biological systems
				Analyze biological phenomena with math and physics to gain important insights
				Explain working of different biomedical instruments
				Select the sensors for given biological applications
				Explain relevant aspect of movement control process
62.	VI	EC3182	Comprehensive Exam - IV	Choose proper techniques to find solution for engineering problems
				Solve various types of problems
				Develop critical thinking and reasoning skills
				Develop ability to face competitive examinations
				Inspect the problem & conclude with proper solution
63.	VI	EC3202	CMOS VLSI Design Lab	Design and simulate schematic of various digital circuits
				Sketch layout of various digital block in CAD Tools
				Analyze various parameters of VLSI logic circuits
				Interpret results and compare with measured values
				Improve the ability to communicate effectively through written lab journals
64.	VI	EC3222	Python Programming Lab	Describe various features and programming aspects of Python
				Demonstrate various functions and operators in Python programming
				Differentiate modular programming approaches through use of functions and modules.
				Implement machine learning algorithms with Tenser Flow
				Solve real world problems using Deep Learning with Tenser Flow
65.	VI	EC324	Electronics Product Design Lab	Develop different modules of electronics product
				Write embedded c-code for electronic product
				Interpret and verify the results
66.	VI	EC3262	Capstone Project Phase-I	Apply knowledge of mathematics, science, physics, engineering and

				management principles to solve complex engineering problems.
				Identify, formulate and analyze engineering problem based on experimental, statistical and computational methods to meet desired needs.
				Design a system, component or process to meet desired needs within realistic constraints.
				Work as a leader or productive member of multi-disciplinary and multi-cultural team.
				Design, simulate, analyze and implement desired systems (hardware and software) by using modern and appropriate tools and techniques
67.	VI	SH3042	Aptitude Technical -II	Develop a thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning Problems
				Understand usage of aptitude terms of speed, time and distance and permutations, probabilities and applications.
				Understand blood relations and ways of seating arrangements along with various geometrical figures
				Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams
68.	VII	EC4012	Computer Network	Describe the networking concept.
				Design network for specific application.
				Analyze performance of the network by implementing various algorithms.
				Illustrate network security aspects.
69.	VII	EC4032	Internet of Things	Describe Elements and importance of IoT ecosystem
				Use IoT protocols, standardization of protocols
				Analyze IoT models and design principles with IoT Architecture
				Illustrate difference between Web of Things and IoT
				Design applications for industry
70.	VII	EC4052	Microwave Theory and Techniques	Explain different Microwave concepts, components and devices
				Analyze RF and Microwave transmission lines.

				Explain different microwave measurement techniques and applications.
				Design microwave systems for different practical applications
71.	VII	EC4072	System Verilog	Describe various concepts of verification methodologies, using system verilog.
				Interpret the results of code snippets
				Model any digital function/module using system verilog
				Write a system verilog verification code for any digital function/module.
				Design digital modules using system verilog
72.	VII	EC4092	Programmable Logic Controller (PLC)	Write PLC ladder programs
				Design Automation systems for industrial applications
				Implement the Engineering Automation using PLC approach
73.	VII	EC4112	Satellite Communication	Discuss the fundamentals of satellite communication.
				Describe different satellite subsystems and satellite applications.
				Design link budget for a satellite.
				Compare different satellite systems.
				Compile recent explorations by space agencies
74.	VII	EC4132	Bio Medical Electronics	Analyze the biological processes like other electronic processes
				Recognize the application of the electronic systems in biological and medical applications.
				Signify the importance of Safety aspects in the medical field
75.	VII	EC4152	Advanced Power Electronics	Explain the operation of power electronics converters with the help of necessary sketches.
				Determine performance parameters of the power electronics converters.
				Analyze the power electronics converters.
				Design power converter to meet desired specifications
76.	VII	EC4172	Cyber Security	97. Apply security measures to real time scenarios
				98. Identify common trade-offs and compromises that are made in the

				design and development process of Information Systems
				99. Design appropriate security technologies and policies to protect computers and digital information
77.	VII	EC4192	Computer Architecture	Describe computer architecture concepts and mechanisms related to the design of modern processors, memories, and networks and explain how these concepts and mechanisms interact.
				Evaluate various design alternatives and make a compelling quantitative and/or qualitative argument for why one design is superior to the other approaches.
				Demonstrate the ability to implement and verify designs of varying complexity at the register-transfer-level.
				Expose the students with different ways of communicating with I/O devices and standard I/O interfaces.
				Create new designs at the register-transfer-level and the associated effective testing strategies.
78.	VII	EC4212	Embedded Linux	Describe basic fundamentals of Embedded Linux
				Write applications in Linux for various peripherals
				Develop a device driver for Embedded Linux
				Design an embedded system using Embedded Linux OS.
79.	VII	EC4232	Computer Networks and IoT Lab	Develop logic for different network algorithms
				Implement and test different algorithm codes
				Build and test Internet of Things applications
80.	VII	EC4252	Microwave Theory and Techniques Lab	Illustrate operation of microwave sources, description of components and guide lines to operate microwave instruments.
				Measure various microwave parameters.
				Design microwave circuit using microwave components

81.	VII	EC4272	System Verilog Lab	Write system Verilog code for given specification
				Interpret the results as per specification
				Use tools for simulation and verification of digital modules
				Analyze the results by comparing with interpreted values
				Demonstrate and communicate effectively through lab journals
82.	VII	EC4292	Programmable Logic Controller (PLC) Lab	Simulate different industry problems using ladder diagram.
				Implement the programs in plc hardware.
				Analyze different analog and digital control techniques with the help of ladder logic
83.	VII	EC4312	Capstone Project Phase II	Analyze result of implemented system to reach proper conclusions.
				Inculcate professional, ethical and moral responsibilities.
				Communicate effectively through reports, presentations and discussions within both the technical domain and the community at large.
				Apply the principles of project management both as a member and a team leader for project development.
				Learn independently and be ready for a lifelong learning to face increasing challenges and responsibilities.
84.	VIII	OE438	Finance for Engineers (Online Course)	Discuss the fundamental aspects of accounting and finance.
				Apply rules of accounting while recording transactions.
				Prepare financial statements and analyze financial position of the firm by applying various techniques.
				Describe the various long term sources of finance available for the business organization
85.	VIII	OE436	Engineering Management and Economics (Online Course)	Develop administrative, organizational and planning skills to execute engineering project.
				Develop bar chart/mile stone chart for the project.
				Analyze profit/cost data and carry out economic analysis to take optimal decision.
				Calculate depreciation as per various methods.
86.	VIII	IP4022	Internship and Project	Examine the functioning of the company on the terms of inputs, transformation process and the outputs (products and services)

				Develop an attitude to adjust with the company culture, work norms, code of conduct.
				Recognize and follow the safety norms, Code of conduct.
				Demonstrate the ability to observe, analyse and document the details as per the industry practices.
				Interpret the processes, systems and procedures and to relate to the theoretical concepts- studies.
				Develop the leadership abilities, communication.
				Demonstrate project management and finance sense
87.	VIII	OE438	Finance for Engineers (Online Course)	Discuss the fundamental aspects of accounting and finance.
				Apply rules of accounting while recording transactions.
				Prepare financial statements and analyze financial position of the firm by applying various techniques.
				Describe the various long term sources of finance available for the business organization
88.	VIII	OE436	Engineering Management & Economics (Online Course)	Develop administrative, organizational and planning skills to execute engineering project.
				Develop bar chart/mile stone chart for the project.
				Analyze profit/cost data and carry out economic analysis to take optimal decision.
				Calculate depreciation as per various methods
89.	VIII	RE4042	Research Project	Investigate the technical literature.
				Recognize and evaluate theories, practices, and/or research on a chosen topic by conducting a thorough literature review and submitting a written integrative, critical summary of the current literature.
				Design a research problem and develop a methodology.
				Develop and implement an advanced original research or creative project.
				Develop the ability to explain the conceptual viability of the project and describe the major components involved.
				Develop the ability to explain how the project will impact the relevant body of work.

				Develop advanced discipline-relevant skills and competencies.
				Construct an accurate record of research performed.
				Write a research report and paper
90.	VIII	ED4102	Project Management	Prepare business Plan for selected business.
				Make risk analysis& market analysis of selected project.
				Make risk analysis& market analysis of selected project
				Make financial appraisal of selected project
91.	VIII	ED4042	Commercial Aspects pf the Project	Interpret basic Financial Terminologies.
				Prepare & analyze financial statements.
				Prepare financial Plan for venture.
				Apply basic principles of marketing for various products.
				Prepare market survey.
				Apply knowledge of marketing management for selected business
92.	VIII	ED4062	Entrepreneurship Development Program (EDP)	Apply knowledge of engineering, economics, marketing and finance for formulation of business plan, starting & managing new business
93.	VIII	ED4082	Entrepreneurship Development Project	Apply knowledge of engineering, economics, marketing and finance for preparation of project report.
				2. Make commercial, technical and financial appraisal of project

- **Department Name:** Electronics & Telecommunication Engineering
- **PG Program Name:** M. Tech Electronics Engineering
- **Vision and Mission: -**

Vision: - Promote excellence in the field of Electronics & Telecommunication Engineering and allied areas through quality education

Mission: -

- To provide quality education through need based curriculum, effective teaching learning process and state-of-art infrastructure.
- To inculcate research aptitude leading to patents and publications in refereed journals.
- To imbibe professional ethics, leadership skills, social, cultural & environmental awareness with a passion for lifelong learning.
- To strengthen relationships with industry, society, government bodies and alumni.

Sr. No.	Program Outcomes
1.	Demonstrate a degree of mastery over electronics engineering
2.	Independently carry out research/investigations and development work to solve practical problems of society and industry
3.	Write and present a substantial technical report/document
4.	Adapt professional, ethical and moral responsibilities
5.	Use knowledge of Project Management and Finance to tackle administrative responsibilities
6.	Explore ideas and engage in lifelong learning

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	I	EEE1014	Advanced Digital Signal Processing	1. Explain techniques available for implementation of digital signal processing system
				2. Design and simulate the working of given digital signal processing system

				3. Evaluate performance of digital signal processing system
				4. Interpret the performance of digital signal processing system
2.	I	EEE1034	VLSI Design	1. Describe VLSI front end and back design of combinational and sequential systems
				2. Model VLSI circuits and System using Verilog HDL
				3. Analyze various parameters of MOS VLSI Circuits
				4. Design circuits and Layout of digital VLSI systems
3.	I	EEE1174	Research Methodology & IPR	1. Formulate a research problem.
				2. Analyze research related information
				3. Use computing tools effectively
				4. Describe nature and processes involved in development of intellectual property rights
4.	I	EEE1194	Advanced Digital Signal Processing Lab	1. Design digital signal processing system based on given specifications
				2. Develop MATLAB program to simulate the working of designed digital signal processing system
				3. Analyze performance of digital signal processing system
				5. Demonstrate effectively though oral/lab report
5.	I	EEE1214	VLSI Design Lab	1. Design circuits and Layout of digital VLSI systems
				2. Model VLSI circuits and Systems using Verilog HDL
				3. Use of Tools and techniques to perform experiment and verify the results
				4. Demonstrate effectively though oral/lab report
6.	I	EEE1054	Wireless Sensor Networks	1. Analyze single node network architecture of WSN
				2. Classify routing and MAC layer protocol in WSN
				3. Develop specific requirements of applications in wireless sensor networks for energy efficiency, computing, storage and transmission
7.	I	EEE1074	Advanced Power Electronics	1.Describe operation and applications of converters
				2.Design magnetic components, heat sinks and converters

				3.Illustrate methods of high power parameters measurements
				4.Justify requirement of power factor correction in utility interface
8.	I	EEE1094	Advanced Computer Architecture	1. Describe advanced concepts of computer architecture
				2. Differentiate of RISC and CISC architectural characteristics
				3. Design structures of Pipeline and Multiprocessor systems
				4. Classify recent computer architectures and I/O devices
9.	I	EEE1114	Soft Computing	1. Describe soft computing techniques and their roles in building intelligent machines
				2. Apply neural networks to pattern classification and regression problems
				3. Solve engineering problems using fuzzy logic
				4. Develop genetic algorithms to combinatorial optimization problems
10.	I	EEE1134	Biomedical Signal Processing	*1.* Analyze genesis of biomedical signals such as the action potential, EMG, ECG, EEG, and heart sound signals
				2. Describe signal processing techniques for filtering, noise removal, and cancellation of interference and characterization of signals
				3. Design and implement techniques for the detection of events such as the QRS complex, heart sounds and murmurs and the dichotic notch
11.	I	EEE1154	Industrial Automation	1. Apply necessary learning directions to deal with the field of industrial automation
				2. Illustrate independent and outside-the-box creative thinking for automation
				3. Develop functional solutions to industrial problems
12.	II	EEE1004	Numerical Computation Techniques	1. Apply the relevant numerical methods for interpolating the polynomial
				2. Solve engineering problems using ordinary differential equations and statistical techniques
				3. Use the relevant method for solving the simultaneous linear equations and compute the Eigen values

				4. Estimate numerically the solution for given algebraic equation
13.		EEE1024	Embedded System Design	1. Describe basic fundamentals of ARM processors
				2. Write programs for LPC2148 controller
				3. Demonstrate the methods of interfacing peripherals with LPC2148
				4. Design an embedded application using LPC2148
14.	II	EEE1044	Antennas and Microwave Engineering	1. Explain different concepts of Antenna and Microwave Engineering
				2. Apply the basic Principles of Antenna and Microwave Engineering
				3. Design and assess the performance of various antennas
				4. Develop microwave systems for various applications
15.	II	EEE1184	Technical Communication	**1.** Acquire skills required for good oral and written communication
				2. Demonstrate improved writing skills and level of readability
				3. Ensure the good quality of technical reports at very first-time submission
16.	II	EEE1204	Embedded System Design Lab	1. Write programs for ARM and DSP controllers
				2. Compile debug and test programs for ARM and DSP controller
				3. Develop application using ARM or DSP controller
				4. Demonstrate through oral/reports
17.	II	EEE1224	Antennas and Microwave Engineering Lab	1. Identify different parameters of Antennas and Microwave structures
				2. Design and Simulate different types of antennas and Microwave structures in Electromagnetic Field solver
				3. Compare the performance of different types of antennas and Microwave structures
				4. Write necessary reports
18.	II	EEE1244	Mini Project	1. Select title of mini-project and formulate its objectives correctly
				2. Develop, simulate and implement the system by complying with desired technical specifications
				3. Analyze and synthesize obtained results in theoretical and practical context
				4. Present findings in logical order

				5. Write a report to document his/her findings
19.	II	EEE1064	Internet of Things	1. Describe the structure of the Internet of thing
				2. Explore to the interconnection and integration of the physical world with cyber space
				3. Develop IOT based application
20.	II	EEE1084	Automotive Electronics	1. Describe components of automotive electronics, its evolution, trends, safety standards and advances towards autonomous vehicles
				2. Develop automotive grade microcontroller based system
				3. Design and model various automotive control systems
21.	II	EEE1104	Network Security	1. Explain network security, services, attacks, mechanisms, types of attacks on TCP/IP protocol suite
				2. Apply network layer security protocols, Transport layer security protocols, Web security protocols
				3. Illustrate authentication services, algorithms
				4. Describe wireless network security threats
22.	II	EEE1124	Machine Learning and Artificial Intelligence	1. Describe basic concepts and techniques of Machine Learning
				2. Develop skills of using recent machine learning software for solving practical problems
				3. Build AI and ML applications
23.	II	EEE1144	VLSI Verification and Testing	1. Write system verilog test benches
				2. Develop verification and testing algorithms
				3. Identify faults/bug in the design
				4. Analyze code coverage and functional coverage
				5. Create reusable verification environment
24.	II	EEE1164	Wireless Communication	1. Design appropriate mobile communication systems
				2. Apply frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, handoff techniques
				3. Distinguish various multiple-access techniques for mobile communications
				4. Analyze path loss and interference for wireless telephony and their influences on a mobile

				communication systems performance
25.	III	EEE2014	Industry Internship	1. Apply engineering knowledge learned during the program
				2. Propose creative and innovative solution to the given problem
				3. Work in multi-disciplinary setting
				4. Show concern for society, environment and other social concerns
				5. Demonstrate given tasks according to the industrial needs with full integrity and responsibility
26.	III	MOE2010	Artificial Intelligence - Machine Learning	1. Describe central machine learning methods and techniques and how they relate to artificial intelligence
				2. Differentiate between supervised and unsupervised learning techniques
				3. Apply the ML algorithms to a real-world problem,
				4. Optimize the models learned and report on the expected accuracy that can be achieved by applying the models.
				5. Evaluate a given problem and apply appropriate machine learning technique
27.	III	MOE2020	Creative Thinking: Tools & Techniques	1. Comprehend importance in tackling global challenges as well as in everyday problem-solving scenarios
				2. Apply different brainstorming techniques in group activities
				3. Be proficient in the application of the 6 thinking hats tool in different life scenarios
				4. Develop a systematic approach to idea generation through the use of morphological analysis
				5. Innovate on an existing product, service or situation applying the SCAMPER method
				6. Get confident with the theory of inventive problem solving, called TRIZ
				7. Select and apply the appropriate technique based on the opportunity to seize or the problem to tackle
28.	III	MOE2030	MOOC Course	1. Identify the real applications and practices of courses studied, at industry level
				2. Recognize various modeling, analysis and validation techniques adopted at industries.

				3. Demonstrate the issues at design, manufacturing and assembly levels.
				4. Summarize and present technical data in report format
29.	III	MOE2040	Condition Monitoring and Signal Processing	1. Identify the maintenance scheme, their scope and limitations – apply the maintenance strategies to various problems in the industrial sectors.
				2. Analyze for machinery condition monitoring and explain how this compliments monitoring the condition.
				3. Develop an appreciation for the need of modern technological approach for plant maintenance to reduce the maintenance expenditure.
				4. Emphasizes on case studies that require gathering information using the modern testing equipment and processing it to identify the malfunction in that system.
				5. Identify vibration measurement, lubrication oil analysis
30.	III	MOE2050	Aircraft Conceptual Design	1. Understand the design process of aircraft and decide the aircraft configuration.
				2. Choose type of power plant as per flight regime.
				3. Decide the fuselage layout as per type of aircraft.
				4. Design the wing for type of aircraft and its wing loading.
				5. Accurately evaluate lift, drag and mass for design synthesis process.
				6. Examine the influence of various design requirements on the configuration of an aircraft to derive an optimized design
31.	III	EEE2034	Dissertation Phase-I	1. Identify research opportunities in his/her domain or multidisciplinary domains
				2. Formulate the problem statement and its objectives correctly
				3. Apply the principles of project management during development of the project
				4. Present synopsis in logical order
				5. Write synopsis of the proposed system
32.	III	EEE2054	Dissertation Phase-II	1. Identify research opportunities in his/her domain or multidisciplinary domains.
				2. Formulate the problem statement and its objectives correctly

				3. Develop, simulate and implement the system by complying with desired technical specifications
				4. Analyze and synthesize obtained results in theoretical and practical context
				5. Present report in logical order
				6. Write report of the system implementation
				7. Apply the principles of project management during development of the project
33.	IV	EEE2004	Dissertation Phase-III	1. Identify research opportunities in his/her domain or multidisciplinary domains.
				2. Formulate the problem statement and its objectives correctly
				3. Develop, simulate and implement the system by complying with desired technical specifications
				4. Analyze and synthesize obtained results in theoretical and practical context
				5. Present report in logical order
				6. Write report of the system implementation
				7. Apply the principles of project management during development of the project
34.	IV	EEE2024	Dissertation Viva Voce (Dissertation Phase-IV)	1. Identify research opportunities in his/her domain or multidisciplinary domains.
				2. Formulate the problem statement and its objectives correctly
				3. Develop, simulate and implement the system by complying with desired technical specifications
				4. Analyze and synthesize obtained results in theoretical and practical context
				5. Present report in logical order
				6. Write report of the system implementation
				7. Apply the principles of project management during development of the project

Information Technology

- **Department Name :- Information Technology**
- **UG Program Name :- B. Tech. - Computer Science and Information Technology**
- **Vision and Mission :-**
    - **Vision:** To become a prominent department of Information Technology producing competent IT professionals with research and innovation skills, inculcating moral values and societal concerns.
    - **Mission:**
        - To offer high quality education through state of art curriculum and innovative teaching & learning practices.
        - To establish state of art laboratories and center of excellence in the field of technology.
        - To adopt professional practice, standards and values.
        - To inculcate problem solving aptitude in graduates with lifelong learning skills to become valuable resource for IT industry and society.
        - To create, share, and apply knowledge in Computer Science and Information Technology, including in interdisciplinary areas that extend the scope of Computer Science and Information Technology to benefit society.

Sr. No.	Program Outcomes
1.	**PO1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and IT engineering specialization to the solution of complex engineering problems.
2.	**PO2: Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics and engineering sciences.
3.	**PO3: Design/Development of solutions:** Design and develop IT solutions using domain knowledge for engineering problems that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4.	**PO4: Conduct investigations of problems:** Use fundamental knowledge and engineering skills including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5.	**PO5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6.	**PO6: 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.	**PO7: 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.	**PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9.	**PO9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10.	**PO10: 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.	**PO11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12.	**PO12: 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.

Sr. No.	Program Specific Outcomes
1.	**PSO1: Domain Specific Knowledge:** Apply the relevant methods and techniques to develop solutions in the domains of automation and intelligent systems.
2.	**PSO2: Software Product Development:** Apply the design and deployment principles to deliver a quality software product for the success of business of varying complexity.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	III	CI2011	Discrete Mathematics	1. Evaluate logic statements using the properties of logic. 2. Apply the concepts in discrete data structures such as sets, relations and functions to solve the problems. 3. Use elementary combinatorics to solve counting problems. 4. Solve examples of lattices, algebraic structures. 5. Prove the theorems and properties of lattices, algebraic structures, graphs. 6. Apply graph theory concepts to solve problems of connectivity.
2.		CI2031	Computer Networks	1. Describe the various network components and topologies. 2. Illustrate the concepts, services, protocols and algorithms used in Computer Networks. 3. Write the terminology and client-server programs using Berkeley socket programming. 4. Solve problems related to routing, framing, error correction, detection and IPv4 addressing. 5. Compare the different services, protocols and algorithms used in Computer Networks.
3.		CI2051	Data Structures and Algorithms	1. Describe the basic terminologies of data structures and algorithms 2. Write algorithms for operations to be performed on data structures 3. Demonstrate the working of stack, queue, linked list, tree and graph

				4. Compare static and dynamic representations of linear and non-linear data structures 5. Choose appropriate data structures while developing solution to the problem
4.		CI2071	Digital Electronics	1. Convert the number from one system to another and vice versa. 2. Explain the basic gates and realize it using universal gate. 3. Minimize the given expression using Boolean algebra and Karnaugh Map 4. Draw a circuit diagram for combinational logic and analyze its properties 5. Design the sequential logic circuits. 6. Describe the 8085 architecture, Identify the instruction set and apply it in assembly language programming using modern tools.
5.		CI2091	Computer Networks Lab	5. Implement client server applications using Berkeley Socket programming 6. Implement programs to demonstrate framing methods, error detecting, correcting methods and routing algorithms. 7. Solve problems based on IPv4 network addressing. 8. Demonstrate the use of various networking tools and utilities. 9. Distinguish between the network hardware and software used for network design.
6.		CI2111	Data Structures and Algorithms Lab	1. Describe the basic terminologies of data structures and algorithms 2. Write algorithms for operations to be performed on data structures 3. Implement stack, queue, linked list, tree and graph data structures in C language 4. Compare static and dynamic representations of linear and non-linear data structures 5. Choose appropriate data structures while developing solution to the problem
7.		CI2131	Digital Electronics Lab	1. Verify the basics of all logic gates using IC Trainer Kit.

				2. Demonstrate the working of Combinational circuits on IC Trainer Kit. 3. Demonstrate the working of Sequential circuits on IC Trainer Kit. 4. Implement the 8085 assembly language program using TASM or simulator.
8.		CI2151	Object Oriented Design and Programming Lab	1. Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects. 2. Illustrate dynamic memory management techniques using pointers, constructors, destructors, etc. 3. Implement the concept of function overloading, operator overloading, virtual functions and polymorphism. 4. Apply inheritance with the understanding of early and late binding, usage of exception handling, generic programming. 5. Develop solution for a given application using various OOPs concepts.
9.		CI2171	Technical Aptitude-I	1. Comprehend the knowledge gained in the course work. 2. Demonstrate the ability in Problem Solving
10.		SH2633	Open Elective-II Professional Skills Development and Foreign Languages – I Professional Leadership Skills	1. Explain the traits of a leadership through real life examples. 2. Exhibit the ability to work effectively in team. 3. Prepare a presentation as per the audience and context requirements
11.		SH2613	Open Elective-II Professional Skills Development and Foreign Languages - I- Interpersonal Skills ('Jeevanvidya' for Work Life Balance)	1. Exhibit interpersonal communication skills. 2. Demonstrate decision-making skills. 3. Apply conflict resolution styles appropriate in different situations. 4. Demonstrate skills to manage balance in work and life. 5. Apply Jeevanvidya wisdom in day to day life.

12.		SH2693	Open Elective-II Professional Skills Development and Foreign Languages – I- Innovation Tools and Methods for Entrepreneurs	1. Explain structured approach to define the problem with every possible detail, identify conflicts and solve them 2. Apply User Journey Map to the selected problem to show user interaction at various stages 3. Analyze the solutions provided by competitors for effectiveness and gaps if any.
13.		SH2593	Open Elective-II Professional Skills Development and Foreign Languages – I-- Personal Effectiveness and Body Language	1. Develop skills to build self-esteem and positive attitude. 2. Develop interpersonal skills characterized by effective communication and conflict resolution. 3. Discover ways to overcome procrastination. 4. Demonstrate responsiveness towards stress and health issues. 5. Interpret the non-verbal behaviour of a person.
14.		SH2733	Open Elective-II Professional Skills Development and Foreign Languages – - German Language- Basic Level	1. Interpret the language if the next person is speaking slowly and clearly. 2. Make use of the language in routine life with the routing topics like family, shopping, work etc. 3. Demonstrate the language by self-introduction in German with simple sentences.
15.		SH2713	Open Elective-II Professional Skills Development and Foreign Languages – - Japanese Language- Level-III	1. Make use of basic conversations in various situations. 2. Identify the sentence patterns. 3. Explain insights about the communication required for living in Japan. 4. Interpret Japanese work ethics required in their professional career.
1.	IV	SH2043	Mathematics for Data Analytics	1. Compute Karl Pearson's Product moment correlation Coefficient and fit the lines of regression. 2. Compute Discrete probability distribution, Continuous probability distributions and Joint probability distributions.

				3. Apply specific probability distributions to real-life examples. 4. Compute the Mathematical formulas for the given fuzzy set. 5. Prove additional properties of alpha-cuts and use extension principle to fuzzy sets. 6. Apply extension principle to fuzzy arithmetic and solve fuzzy equations.
2.		CI2021	Automata Theory	1. Predict the regular expression for given language 2. Design computational models for given language 3. Parse the given string using top down & bottom up parsing 4. Construct the CFG for given language 5. Prove the properties of regular language and context free language
3.		CI2041	Software Engineering	1. Describe fundamental concepts in software engineering and project management 2. Practice software process models for the undertaken software problems 3. Design function-oriented and object oriented models using modern tools. 4. Compare different software testing techniques and strategies. 5. Apply the project management concepts for the undertaken software problems 6. Illustrate concepts of project monitoring and control in software development
4.		CI2061	Computer Organization	1. Describe the basic structure of computers with its different components. 2. Perform the basic arithmetic operations like Number complements and floating points. 3. Analyze the machine's instruction set architecture (ISA). 4. Categorize memory organization and explain the function of each element of a memory hierarchy. 5. Illustrate the different ways of communicating with I/O devices. 6. Classify the different hazards occurred in pipelining.
5.		CE2263	Engineering Mechanics	1. Classify various forces and their effects, to analyze real life problems.

				2. Analyze engineering problems applying conditions of equilibrium. 3. Determine Centroid & Moment of Inertia of the geometrical plane lamina 4. Apply fundamental concepts of Kinematics and Kinetics to analyze practical problems
6.		CI2081	Python lab	1. Explain the concepts in python. 2. Implement program using loops, decision statements and functions in Python. 3. Use object oriented programming with classes and modules using python. 4. Implement file handling and database handling using python. 5. Plot data using appropriate Python visualization libraries.
7.		CE2283	Engineering Mechanics Lab	1. Compare coefficient of friction of various surfaces in contact. 2. Correlate theoretical and practical results of support reactions and Centroid of plane lamina. 3. Verify law of polygon of forces, law of triangle of forces and principle of moment
8.		SH2173	Environmental Science	1. Discuss the importance and sensitivity of environment. 2. Interpret the over exploitation of natural resources and follow the environmental ethics. 3. Explain methods to protect environment and prevent environmental pollution 4. Apply their knowledge and skills to solve environment related problems.
9.		SH2603	Environmental Science Project	1. Utilize scientific methods to solve environmental problems. 2. Evaluate technologies for restoration of degraded environment. 3. Develop presentation and report writing skills. 5. Develop as an individual and in group leadership quality.

10.		CI2101	Technical Aptitude-II	1. Comprehend the knowledge gained in the course work. 2. Demonstrate the ability in Problem Solving
11.		SH2633	Open Elective-II Professional Skills Development and Foreign Languages – I Professional Leadership Skills	1. Explain the traits of a leadership through real life examples. 2. Exhibit the ability to work effectively in team. 3. Prepare a presentation as per the audience and context requirements
12.		SH2613	Open Elective-II Professional Skills Development and Foreign Languages - I- Interpersonal Skills ('Jeevanvidya' for Work Life Balance)	1. Exhibit interpersonal communication skills. 2. Demonstrate decision-making skills. 3. Apply conflict resolution styles appropriate in different situations. 4. Demonstrate skills to manage balance in work and life. 5. Apply Jeevanvidya wisdom in day to day life.
13.		SH2693	Open Elective-II Professional Skills Development and Foreign Languages – I- Innovation Tools and Methods for Entrepreneurs	1. Explain structured approach to define the problem with every possible detail, identify conflicts and solve them 2. Apply User Journey Map to the selected problem to show user interaction at various stages 3. Analyze the solutions provided by competitors for effectiveness and gaps if any.
14.		SH2593	Open Elective-II Professional Skills Development and Foreign Languages – I-- Personal Effectiveness and Body Language	1. Develop skills to build self-esteem and positive attitude. 2. Develop interpersonal skills characterized by effective communication and conflict resolution. 3. Discover ways to overcome procrastination. 4. Demonstrate responsiveness towards stress and health issues. 5. Interpret the non-verbal behaviour of a person.

15.		SH2643	Open Elective-II Professional Skills Development and Foreign Languages – - German Language-Advanced Level	1. Interpret the language if the next person is speaking slowly and clearly. 2. Make use of the language in routine life with the routing topics like family, shopping, work etc. 3. Demonstrate the language by self-introduction in German with simple sentences.
16.		SH2623	Open Elective-II Professional Skills Development and Foreign Languages – - Japanese Language-Level-IV	1. To be able to make basic conversations in various situations. 2. To recognize the sentence patterns. 3. To improve Japanese Language proficiency. 4. To give students insights about the communication required for living in Japan. 5. To expose students to the Japanese work ethics required in their professional careers.
1.	V	CI301	Operating Systems	1. Explain fundamental concepts in operating systems 2. Apply the concepts of operating systems for the given requirement 3. Select the appropriate algorithm such as scheduling, deadlock, page replacement or disk scheduling for devising solution to the given problem 4. Compare various operating system techniques 5. Justify findings of the given problem using operating system concepts
2.		CI303	Database Management Systems	1. Describe the fundamental elements of relational database management systems. 2. Design ER-models to represent simple database application scenarios 3. Write SQL/PL-SQL query to perform various operations on the database. 4. Apply integrity constraints on database. 5. Apply concepts of indexing and hashing on databases. 6. Illustrate the transaction management, concurrency control and crash recovery.
3.		CI305	Design and Analysis of Algorithms	1. Apply mathematics needed for the analysis of algorithms.

				2. Use asymptotic analysis to analyze the performance of algorithms. 3. Compare various searching and sorting algorithms. 4. Apply different algorithm design techniques to solve real life problems like change making problem, job sequencing, finding shortest path, etc. 5. Identify appropriate algorithm design strategy that is applicable to a given contextual problem. 6. Describe Computational complexity theory to classify computational problems according to their inherent difficulty.
4.		CI307	Program Elective-I - Organizational Management and Behavior	1. Describe & apply a selection of key concepts/theory/frameworks relevant to management. 2. Discuss the basic concepts of operation, financial, material and marketing management. 3. Present/Solve for the case study based on management and organizational behavior concepts. 4. Review basic concepts of organizational behavior and group and interpersonal processes like team, group management and conflict management and handling. 5. Relate organizational culture and performance and the organizational change
5.		CI309	Program Elective-I - IPR and Cyber Laws	1. Describe fundamental terms in cybercrime legislations. 2. Compare various cyber-attacks & offenses. 3. Analyze Indian IT Act 2000 & amendments in IT Act 4. Demonstrate cyber forensics investigations using modern tools & techniques. 5. Construct a strategy for creating awareness about cyber security for e-banking and legal issues among the social community.
6.		CI311	Program Elective-I - Software Modeling & Design	1. Identify object classes and build the domain model using advanced concepts in object, dynamic and functional modeling. 2. Apply different object-oriented design techniques. 3. Design models using UML diagrams for software systems: use case, class, sequence, collaboration, activity, state chart diagrams, component and deployment.

				4. Design software systems using open source and advanced modeling tools. 5. Evaluate designs of software systems in mini-projects, projects using Software Modeling & Design concepts.
7.		CI313	JAVA Programming Lab	1. Explain the concepts and terminologies in java programming language 2. Create class hierarchy using Java inheritance and interface for given requirement. 3. Implement programs on Exception Handling, Packages , File Handling using IDE's 4. Design GUI based applications by using AWT and Swing package for given problem. 5. Develop Java applications to address particular software needs by making use of collections classes.
8.		CI315	Database Management Systems Lab	1. Draw Schema Diagram on given problem statement. 2. Write SQL query for various operations like retrieval, insertion and manipulation of data etc. 3. Implement PL/SQL cursor, procedure/function and trigger. 4. Implement a program to connect databases to application programs. 5. Implement basic commands of MongoDB with installation.
9.		CI317	Operating Systems Lab	1. Identify and use the basic and advanced commands in Unix 2. Practice simple and advanced filters of Unix system using regular expression 3. Implement shell scripts and shell programs for given problems 4. Practice user management administration in Unix
10.		SH3032	Aptitude Training-I	1. Develop a thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning problems. 2. Understand usage of basic aptitude terms of percentages, averages, ratios and applications of business aptitude terms of profits and interests 3. Develop a bridge in analogies, series and visualizing directions.

				4. Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams.
11.		CI319	Summer Internship	1. Apply the theoretical and practical knowledge of CS/IT Engineering for product/service development. 2. Undergo real time IT Industry practices regarding product/service development. 3. Identify and analyze engineering problems to provide IT based solutions. 4. Adopt recent industry practices for project development 5. Improve the ability to work in teams 6. Enhance technical skills for solving complex engineering problems.
12.		CI321	Comprehens ive Exam-III	1. Comprehend the knowledge gained in the course work. 2. Demonstrate the ability in Problem Solving
13.		SH301	Indian Constitution	1. Create awareness about law depiction and importance of Constitution 2. Define Fundamental Rights and Fundamental Duties of the Indian Citizen to instill morality, social values, honesty, dignity of life and their social Responsibilities. 3. Create Awareness of their Surroundings, Society, Social problems and their suitable solutions while keeping rights and duties of the citizen keeping in mind. 4. Recognize distribution of powers and functions of Local Self Government. 5. Comprehend the National Emergency, Financial Emergency and their impact on Economy of the country.
1.	VI	CI302	Information Security	1. Describe the fundamentals of information security, security model, legal and ethical issues, risk management. 2. Apply **cipher techniques and cryptographic algorithms to perform encryption and decryption.** 3. Analyze the ways to provide access control like authorization and authentication. 4. Illustrate the working of several real-world security protocols.

				5. Summarize the security provisions in software, operating system and data. 6. Explain the model for implementing information security and maintain the security of information systems.
2.		CI304	Program Elective-II – Data Mining	1. Categorize and carefully differentiate between situations for applying different classification or clustering algorithms and evaluate their performance. 2. Apply different algorithms to generate association rules. 3. To predict the outcome of certain problem using data mining techniques. 4. Apply appropriate data mining algorithm to any given data set to solve real world problems. 5. To develop skills of using recent data mining software for solving practical problems. 6. Develop the framework for web mining.
3.		CI306	Program Elective-II - Sensor Networks	1. Explain the basic terminology, architecture and concepts of Sensor networks. 2. Identify the different Platforms, Communication Technologies and Protocols in Sensor networks. 3. Apply time-synchronization strategy for any wireless sensor application. 4. Identify the security issues and challenges in wireless sensor networks. 5. Compare different Sensor Network Platforms and Tools.
4.		CI308	Program Elective-II - Machine Learning Algorithms	1. Differentiate Machine Learning algorithms from traditional algorithms. 2. Apply Regression algorithms to predict the values for given applications. 3. Analyze the Classification and Clustering techniques. 4. Compare the strengths and weaknesses of different Machine Learning algorithms. 5. Elaborate the working of the Recommendation System and its importance in different application domains. 6. Evaluate performance of Artificial Neural Networks on different parameters such as architecture, learning rate etc.

5.		CI310	Program Elective-II – Computer Vision	1. Identify basic concepts, terminology, theories, models and methods in the field of computer vision. 2. Choose the appropriate image processing methods for image segmentation. 3. Apply computer vision techniques for solving practical problems on Area Extractions. 4. Analyze the accuracy of the methods used in Region Analysis. 5. Illustrate basic methods of computer vision related to Facet Model Recognition 6. Explain the different forms of Knowledge Representation methods used in computer vision
5.		CI312	Program Elective-III - Soft Computing	1. Gain understanding of various soft computing techniques. 2. Identify and design fuzzy based systems. 3. Explore different selection, crossover and mutation operators of genetic algorithm. 4. Analyze performance of different evolutionaryalgorithms for mathematical and real-world optimization problems. 5. Identify and formulate complex problems from different engineering domains.
6.		CI314	Program Elective-III - Human Computer Interaction	1. Identify the advantages of good graphic interface design 2. Describe human needs in the contexts of graphical user interface 3. Analyze the steps involved in the design process of human computer interaction. 4. Develop graphical user interface for a given Screen specification. 5. Demonstrate the different Software tools used for Interaction devices. 6. Design effective HCI for mobile and web.
7.		CI316	Program Elective-III – Software Testing	1. Describe software testing fundamentals. 2. Explain different software testing types.

				3. Design/build test cases based on different test case design techniques. 4. Make use of modern automation tools for testing a given software system. 5. Produce test case reports using manual and automation testing for given case studies.
8.		OE320	Artificial Intelligence (Open Elective-IV)	1. Explain fundamentals of classical and modern AI. 2. Implement a wide range of AI concepts. 3. Demonstrate various applications of AI in intelligent agents and knowledge acquisitions. 4. Design appropriate machine learning algorithm for Uncertain Knowledge representation. 5. Design expert systems using AI technique and machine learning. 6.
9.		OE322	Cyber Forensics (Open Elective-IV)	1. Understand the basics of computer forensics 2. Identify the vulnerabilities in a given network infrastructure 3. Implement real-world hacking techniques to test system security 4. Apply a number of different computer forensic tools to a given scenario 5. Analyze and validate forensics data
10.		SH302	Biology for Engineers	1. Apply biological engineering principles, procedures needed to solve real-world problems 2. Demonstrate the functions of biological systems 3. Analyze biological phenomena with math and physics to gain important insights 4. Explain working of different biomedical instruments 5. Select the sensors for given biological applications 6. Explain relevant aspect of movement control process.
11.		CI318	C#. Net Lab	1. Describe .NET framework & fundamentals. 2. Implement object oriented concepts. 3. Implement Multi-threaded and file handling programs. 4. Implement Database programming with ADO.NET 5. Implement Exception handling programs. 6. Develop desktop applications.

12.		CI320	Mobile Application Development Lab	1. Explain the basic concepts and terminologies of Android technology 2. Design User Interfaces using views, layout managers, menus and dialogs 3. Make use of shared preferences, files and SQLite database for persistent data storage and multimedia in android application 4. Develop mobile application using activity, services, content providers and broadcast receivers of Android Technology 5. Apply testing frameworks, packaging and deploy android application to emulators and physical devices
13.		CI322	Capstone Project Phase-I	1. Apply the theoretical and practical knowledge of CS/IT Engineering for product/service development 2. Identify and analyze engineering problems to provide IT based solutions 3. Design efficient algorithms for better products/services 4. Adopt recent industry practices for project development 5. Improve the ability to work in teams 6. Develop effective presentation and communication skills through projects 7. Manage the project in terms of scope, cost, time and quality of project as defined by stakeholders
14.		SH3052	Aptitude Training-II	1. Develop a thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning Problems 2. Understand usage of aptitude terms of speed, time and distance and permutations, probabilities and applications. 3. Understand blood relations and ways of seating arrangements along with various geometrical figures 4. Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams.
15.		CI324	Comprehensive Exam-IV	1. Comprehend the knowledge gained in the course work. 2. Demonstrate the ability in Problem Solving

1.	VII	IT4012	Software Testing	1. Describe software testing fundamentals. 2. Explain different software testing types. 3. Design/build test cases based on different test case design techniques. 4. Make use of modern automation tools for testing a given software system. 5. Produce test case reports using manual and automation testing for given case studies.
2.		IT4032	Neural Network and Deep Learning	1. Describe the ideological basics of artificial neural networks. 2. Identify the different structures of artificial neural networks. 3. Formalize the problem and solve it by using a neural network. 4. Illustrate the fundamental issues and challenges of Deep learning. 5. Design the various deep neural network systems. 6. Implement various Deep learning algorithms in a range of real-world applications.
3.		IT4052	Parallel Computing (PE-IV)	1 Summarize parallel programming technique and compare it with Sequential Programming 2 Develop programs to use multi-core processors using OpenMP 3 Write an parallel programs using MPI 4 Explore different features of the CUDA framework. 5 Identify the different CUDA capable GPU platforms. 6 Design a parallel algorithm for any compute-intensive application.
4.		IT4072	Big Data (PE-IV)	1. Understand the need of Big data Technologies. 2. Write program using Map Reduce framework. 3. Describe Hadoop and its component 4. Write the queries using HIVEQL 5. Use Hadoop ecosystem like Pig and Hive to build application
5.		IT4092	Recent IT Technologies (PE-IV)	1. Explore the recent tools and technologies of IT. 2. Identify the ethical considerations of developing IT applications

				3. Describe the potential benefits of using IT technology in the real world
6.		IT4112	Data Mining (PE-IV)	1. Categorize and differentiate between situations for applying different classification or clustering algorithms and evaluate their performance. 2. Demonstrate various data preprocessing techniques. 3. Apply different algorithms to generate association rules. 4. To predict the outcome of certain problem using data mining techniques. 5. Apply appropriate data mining algorithm to any given data set to solve real world problems. 6. Handle complex datasets like Text mining, web mining, stream mining and other. (Use recent data mining tools and techniques for solving practical problems)
7.		IT4132	Data Analytics (PE-V)	1. Differentiate the characteristics of datasets and compare the trivial data and big data for various applications. 2. Select and implement techniques and computing environment that are suitable for the data analytical applications. 3. Solve problems associated with the data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues. 4. Understand and apply scaling up machine learning techniques and associated computing techniques and technologies for data analytical. 5. Provide problem solutions for multi-core or distributed, concurrent/Parallel environments.
8.		IT4152	Internet of Things (PE-V)	1. Describe the applications, basic terminologies and fundamentals of IoT. 2. Illustrate the different IoT platforms, communication standards and protocols. 3. Identify the security issues and challenges in IoT. 4. Design and develop the IoT solutions for real word problems. Prepare an IoT case studies for smart applications.

9.		IT4172	Computer Graphics and Virtual Reality (PE-V)	1. Describe the basic concept and framework of virtual reality and development tools. 2. Illustrate the principles and multidisciplinary features of virtual reality 3. Describe the technology for multimodal user interaction and perception in VR (visual, audial and haptic interface and behavior). 4. Discuss the technologies for managing large-scale VR environment in real time. 5. Analyze the virtual reality issues.
10.		IT4192	Front End Web Technology Lab	1. Design and develop elegant and responsive Front-end by leveraging latest technologies 2. Build strong foundations (ex: Design pattern) in entry level engineers thereby making them job ready as per industry requirements. 3. Learn new technologies by applying foundation paradigms 4. Become an industry-ready engineer who can be readily deployed in a project 5. Design and develop websites using fundamental web languages, technologies, and tools. 6. Apply the concepts of web technologies for the given requirement
11.		IT4212	Advanced Java Laboratory (PE Lab)	1. Use Bootstrap to make web application responsive. 2. Build fast and interactive web application using JQuery and Angular JS2 3. Develop dynamic, server-side applications using Servlets. 4. Develop dynamic, server-side applications using JSP. 5. Build web applications using Hibernate framework.
12.		IT4542	R Programming (PE Lab)	1. Implementation of core concepts of R programming using R studio and console 2. Implement basic statistical operations using R Programming. 3. Apply suitable type of data distributions to different engineering problems

				4. Create charts, plots and vectors for graphical analysis. 5. Solve Machine Learning Algorithms Using R Programming
13.		IT4552	Asp.Net (PE Lab)	1. Develop dynamic web application using ASP.NET. 2. Apply front end technologies to make web application responsive and fast. 3. Develop web application using MVC and Entity framework. 4. Build web services in ASP.NET.
14.		IT4272	Capstone Project Phase- II	**1.** Apply the theoretical and practical knowledge of CS/IT Engineering for product/service development **2.** Identify and analyze engineering problems to provide IT based solutions **3.** Design efficient algorithms for better products/services **4.** Develop the project using modern IT tools, techniques and technologies **5.** Adopt recent industry practices for project development **6.** Improve the ability to work in teams

Mechanical Engineering

- **Department Name :- Mechanical Engineering**
- **UG Program Name :- B.Tech. Mechanical Engineering**
- **Vision and Mission :-**

Vision: To transform the department into center of excellence by synergizing teaching, learning and research to produce globally competent Mechanical Engineers who are innovative, entrepreneurial, and successful in advanced fields of engineering and research.

Mission:

- To impart better quality education to the students for grooming them into globally competent mechanical engineers by building their capacity and strengthening skills.
- To collaborate with research organizations, reputed educational institutions, industries and alumni for excellence in teaching, research and consultancy practices.
- To develop state of the art facilities to stimulate faculty, staff and students to create, analyze, apply and disseminate knowledge.

Sr. No.	Program Outcomes
13.	Apply the knowledge of mathematics, science, engineering fundamentals, and mechanical engineering to the solution of complex engineering problems.
14.	Identify, formulate, review research literature, and analyze complex mechanical engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
15.	Design solutions for complex mechanical 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.
16.	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.
17.	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex mechanical engineering activities with an understanding of the limitations.
18.	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.
19.	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
20.	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
21.	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

22.	Communicate effectively on complex mechanical 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.
23.	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.
24.	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.

Sr. No.	Program Specific Outcomes
3.	Use Company standards, national and international standards like IS BS, SAE, ISO, ASTM etc for designing and manufacturing of mechanical components and systems.
4.	Engage professionally in industries or as an entrepreneur by applying manufacturing, design, thermal and management practices.

2021-22

Semester	Course Name	Course Code	Course Outcome
Semester-III	**Material Science & Metallurgy**	**ME2013**	Explain different alloys, their properties and applications by referring equilibrium diagrams.
			Determine mechanical properties by destructive testing methods.
			Detect flaws in components by non-destructive testing methods.
			Select suitable heat treatment to achieve desired changes in mechanical properties of steels.
			Select suitable material for given engineering applications.
	Engineering Thermodynamics	**ME2033**	Apply laws of thermodynamics to various flow devices
			Describe entropy, change in entropy and increase of entropy principle.
			Compute available and unavailable energy of a substance
			Recognize the properties of pure substances and use thermodynamic property tables, charts.
			Apply mathematical fundamental to study the properties of steam gas and gas mixtures
			Compute performance of various thermodynamic air and vapor power cycles.
	Engineering Mechanics	**ME2053**	Calculate the resultant for concurrent and non-concurrent force systems.
			Recognize the importance of D'Alembert's principle, apply it in plane motion and connected bodies.
			Draw the free body diagram and apply the equations of equilibrium to 2D and 3D rigid bodies
			Explain particle dynamics and compute various forms of stored energy under gradually and suddenly applied load conditions
			Apply the D'Alembert's, Work Energy and collision principle to analysis in plane motion bodies.
	Fluid Mechanics	**ME2073**	Define, calculate, measure properties of fluid
			Apply continuity equation, Bernoulli's equation, equation of motion and momentum equation for different flow system.
			Identify different types of flows & forces acting on fluid.
			Estimate forces acting on bodies submerged in fluid.
			Estimate forces acting on bodies submerged in fluid

			Apply basic concept of fluid mechanics for dimensional analysis & compressible flow.
	Manufacturing Processes and Machine Tools	**ME2093**	Select casting as manufacturing process suitable for the component design and production volume
			Select suitable furnaces in casting process as per requirement.
			Select appropriate joining process for given application.
			Select suitable Engineering forming process for production of component of required specification
			Select machine tools for metal cutting operations.
	Electrical Technology	**ME2113**	Explain different types of electrical machines, their characteristics and control.
			Analyze different types of electrical machines.
			Explain electric drives and electric heating.
	Environmental Science	**SH2173**	Discuss the importance and sensitivity of environment.
			Interpret the over exploitation of natural resources and follow the environmental ethics.
			Explain methods to protect environment and prevent environmental pollution
			Apply their knowledge and skills to solve their environment related problems
	Engineering Mechanics Lab	**ME2513**	Demonstrate the various laws studied in engineering mechanics
			Calculate the forces and deflection in structural member
			Develop the physical sense towards the engineering mechanics term and establish relation between them
	Fluid Mechanics and Electrical Technology Lab	**ME2533**	Verify and apply Bernoulli's Theorem. apparatus Determine coefficient of discharge of fluid flow
			Calculate various losses through pipes.
	Material Science Lab	**ME2553**	Illustrate stress strain diagram for Mild steel.
			Use Rockwell Hardness testing machine to measure hardness of material.
			Correlate mechanical properties with microstructures of steel and cast iron.
			Test materials for their impact strength.
			Classify steels by spark testing method.
			Heat treat the given specimen to alter the mechanical properties.
			Measure Hardenability of given steel using Jominy End Quench Test
	Workshop Practice –I	**ME2573**	Demonstrate effect of variables such as Voltage,current on welding process.
			Produce given joint by MIG welding process.
			Produce welding run on S.S. by TIG welding.
			Produce welding run on Aluminum by TIG welding.
			Produce given job with proper taper and V threading within dimensional tolerances ± 0.2 m.m. on diameter and ± 0.5 m.m. on length. (Job – A)
	Technical Aptitude -I	**ME2593**	Apply the knowledge acquired during the course work.
			Develop the ability of problem solving.
		SH2603	Utilize scientific methods to solve environmental problems.
			Evaluate technologies for restoration of degraded environment.

	Environmental Science Project		Develop presentation and report writing skills. Develop as an individual and in group leadership quality
	Professional Leadership Skills	**SH2633**	1. Explain the traits of a leadership through real life examples. 2. Exhibit the ability to work effectively in team. 3. Prepare a presentation as per the audience and context requirements.
	Interpersonal Skills ('Jeevanvidya' for Work Life Balance)	**SH2613**	1. Exhibit interpersonal communication skills. 2. Demonstrate decision-making skills. 3. Apply conflict resolution styles appropriate in different situations. 4. Demonstrate skills to manage balance in work and life. 5. Apply Jeevanvidya wisdom in day to day life.
	Innovation Tools and Methods for Entrepreneurs	**SH2693**	1. Explain structured approach to define the problem with every possible detail, identify conflicts and solve them 2. Apply User Journey Map to the selected problem to show user interaction at various stages 3. Analyze the solutions provided by competitors for effectiveness and gaps if any.
	Personal Effectiveness and Body Language	**SH2593**	1. Develop skills to build self-esteem and positive attitude. 2. Develop interpersonal skills characterized by effective communication and conflict resolution. 3. Discover ways to overcome procrastination. 4. Demonstrate responsiveness towards stress and health issues. 5. Interpret the non-verbal behaviour of a person.
	German Language - Basic Level	**SH2733**	1. Interpret the language if the next person is speaking slowly and clearly. 2. Make use of the language in routine life with the routing topics like family, shopping, work etc. 3. Demonstrate the language by self-introduction in German with simple sentences
	Japanese Language - Level III	**SH2713**	1. Make use of basic conversations in various situations. 2. Identify the sentence patterns. **3.** Explain insights about the communication required for living in Japan. 4. Interpret Japanese work ethics required in their professional career.

Semester	**Course Name**	**Course Code**	**Course Outcome**
Semester-IV	**Engineering Mathematics – III**	**SH2063**	**1.** Evaluate differential equation using appropriate concept. **2.** Analyze system and its mathematical model and select suitable differential equation method to solve model. **3.** Analyze the problem and apply the concept of partial differential equations. **4.** Evaluate Laplace & inverse Laplace transform of function and solve ordinary differential equations and linear time invariant systems. **5.** Develop Fourier series of periodic functions. **6.** Apply the concept of Fourier transform to engineering problems.
	Strength of Materials	**ME2023**	**1.** Determine different types of stresses and strains induced in any machine component.

			2. Develop shear force and bending moment diagram for different types of beam. **3.** Determine stress distribution for various cross sections of beam. **4.** Estimate the deflection of beams by analytical and graphical method **5.** Analyze axially loaded column for different end conditions.
	Applied Thermodynamics	**ME2043**	**1.** Differentiate SI and CI engine and cycles and relate different performance parameters, and compare different pollution norms **2.** Illustrate and analyse the performance of various the refrigeration system. **3.** Differentiate between various types of boilers and evaluate performance of boiler **4.** Design a steam nozzle for given condition and calculate nozzle efficiency **5.** Compute different efficiencies and power developed by impulse and reaction turbine. **6.** Estimate cooling water required and calculate vacuum and condenser efficiency.
	Tool Engineering	**ME2063**	**1.** Explain the mechanism of metal cutting. **2.** Analyze the effect of various parameters such as process variables, cutting tool materials etc. on the performance of machining. **3.** Explain the importance of the various elements of tool geometry of single and multi-point cutting tools. **4.** Design jigs and fixtures for given components. **5.** Design press tools for cutting and forming press working operations. **6.** Estimate machining cost.
	Kinematics of Machines	**ME2083**	**1.** Select suitable mechanisms for given application **2.** Analyze the mechanism for velocity and acceleration **3.** Design the CAM for given condition **4.** Apply appropriate power transmission method for mechanical system **5.** Analyse kinematically flywheel, governor and gear system **6.** Synthesize given mechanical system
	: **Computer Programming C++**	**ME2103**	**1.** Build Object Oriented Programs. **2.** Elaborate the concepts of "inline function", "friend function", "function overloading" and "operator overloading". **3.** Extend the program by using inheritance. **4.** Use memory management technique "constructors" & "destructors". **5.** Handle different file handling techniques like "Create', "Open", "Close" files and perform "Read", "Write" and "Append" operations. **6.** Write C^{++} programme to draw simple geometric shapes.
	Applied Thermodynamics Laboratory	**ME2503**	**1.** Exposure to constructional details of engine, compressor and its components **2.** Perform testing on different systems **3.** Analyze effect of different variables on performance of systems.
	Machine Drawing Lab	**ME2523**	**1.** Recognize the significance & importance of BIS conventions **2.** Identify & draw the proportionate dimensioned free hand sketches of various engineering components. **3.** Prepare details & assembly drawing from given detail drawings

			4. Prepare the manufacturing drawing **5.** Identify appropriate limits, fits, tolerances, tolerances of form & position, surface finish symbols for given machine components & incorporate the same in the orthographic drawing of given machine component **6.** Identify & draw the curves of interpenetration
	Computer Programming C++ Lab	**ME2563**	**1.** Build Object Oriented Programs. **2.** Elaborate the concepts of "inline function", "friend function", "function overloading" and "operator overloading". **3.** Extend the program by using inheritance. **4.** Use of memory management technique "constructors" & "destructors". **5.** Handle different file operations like "Create', "Open", "Close" files and perform "Read", "Write" and "Append" operations. **6.** Write programs to draw simple geometric shapes.
	Workshop Practice – II	**ME2583**	**1.** Demonstrate effect of variables such as speed, feed and depth of cut on machining process **2.** Produce given job with proper taper fitting and within dimensional tolerances ± 0.2 m.m. on diameter and ± 0.5 m.m. on length. (Job – b) **3.** Produce given job with proper V threading fitting and within dimensional tolerances ± 0.2 m.m. on diameter and ± 0.5 m.m. on length. (Job – c) **4.** Produce given job of sq. threading of given specifications. (Job – D)
	Technical Aptitude -II	**ME2603**	**1.** Apply the knowledge acquired during the course work. **2.** Develop the ability of problem solving
	Interpersonal Skills ('Jeevanvidya' for Work Life Balance)	**SH2613**	**1.** Exhibit interpersonal communication skills. **2.** Demonstrate decision-making skills. **3.** Apply conflict resolution styles appropriate in different situations. **4.** Demonstrate skills to manage balance in work and life. **5.** 5. Apply Jeevanvidya wisdom in day to day life.
	Innovation Tools and Methods for Entrepreneurs	**SH2693**	**1.** Explain structured approach to define the problem with every possible detail, identify conflicts and solve them **2.** Apply User Journey Map to the selected problem to show user interaction at various stages **3.** Analyze the solutions provided by competitors for effectiveness and gaps if any.
	Personal Effectiveness and Body Language	**SH2593**	**1** Develop skills to build self-esteem and positive attitude. **2**. Develop interpersonal skills characterized by effective communication and conflict resolution. **3**. Discover ways to overcome procrastination. **4**. Demonstrate responsiveness towards stress and health issues. **5**. Interpret the non-verbal behaviour of a person.
	German Language - Advanced Level	**SH 2643**	**1.** Interpret the language if the next person is speaking slowly and clearly. **2.** Make use of the language in routine life with the routing topics like family, shopping, work etc. **3.** Demonstrate the language by self-introduction in German with simple sentences
	Japanese Language - Level IV	**SH2623**	1) To be able to make basic conversations in various situations. 2) To recognize the sentence patterns. 3) To improve Japanese Language proficiency. 4) To give students insights about the communication

			required for living in Japan. 5) To expose students to the Japanese work ethics required in their professional careers.

Semester	Course	Course Code	Course Outcome
Semester V	**Dynamics of Machines**	**ME3012**	Apply the theoretical knowledge to balance the rotary and reciprocating systems
			Identify and investigate the stability of spinning bodies due to the gyroscopic effect
			Apply different principles to convert the physical vibratory system into a mathematical model
			Identify the effect of external excitation on the system and effect of dampers to control the system vibration
			Recognize the suitable method for minimizing or eliminating the vibration from the system
	Design of Machine Elements	**ME3032**	**1.** Identify the customers need, formulate the problem and draw the design specifications.
			2. Design a machine component using theories of failure.
			3. Design a simple machine components like joints, shafts, keys, couplings
			4. Design a spring and power screw
			5. Select a rope and belt drives for given application
			6. Design a component against fluctuating load.
	Metrology & Control Engineering	**ME3052**	**1.** Apply knowledge of various tools and techniques to determine geometry and dimensions of components in engineering applications.
			2. Design system to meet desire needs within realistic constraints.
			3. Analyze and interpret data by using QC tools.
			4. Explain feedback control system.
			5. Represent control system mathematically and by using block diagrams and determine their response to various input conditions.
	Heat Transfer	**ME3072**	1. Explain fundamental concepts heat transfer
			2. Analyze heat conduction, convection and radiation phenomenon
			3. Formulate and Solve problems on different modes of heat transfer.
			Design a heat exchanger
	Workshop Practice – V	**ME3512**	Demonstrate effect of variables such as speed, feed and depth of cut on machining process
			Produce given job with proper taper fitting and within dimensional tolerances ± 0.1 mm on diameter and ± 0.2 mm on length. (Job A)
			Produce bearing diameter on job a maintaining fit H7g6.
			Produce Gear Teeth - Job B on Milling Machine as per specifications.
			Produce Job C to fit Job A with proper threading fitting on Turret.
			Prepare process sheet for all Jobs

	Dynamics of Machinery Lab	**ME3532**	To identify and investigate the stability of spinning bodies due to gyroscopic effect.
			To apply the theoretical knowledge to balance the rotary and reciprocating systems.
			To determine natural frequency, damped frequency and resonant frequency of any vibratory system.
			To recognize the whirling speed conditions of shaft and methods to eliminate it.
			To determine natural frequencies and mode shapes of vibratory system with two degree of freedom.
	Metrology and Measurement lab	**ME3552**	Use Vernier Caliper, Vernier Height Gauge, and Micrometer, V-block for accurate linear and angular Measurement
			Demonstrate and use the tool makers Microscope for the measurement of screw thread terminology
			Measure the straightness using Autocollimator
			Measurement of screw thread parameter using floating carriage micrometer**.**
			Conduct Gauge R & R Study.
			Use load cell for measurement of Force.
			Select suitable tachometer for speed measurement.
	Thermal Engineering Lab-II	**ME3572**	Analyze heat conduction experimentally
			Compare heat transfer coefficient in natural as well as forced convection environment.
			Determine emissivity and Stefan Boltzmann constant for the case of radiation
			Evaluate the performance of heat exchanger.
	CAD-Modelling	**ME3592**	List the different CAD software used for mechanical engineering. Create sketches of machine parts. Model machine parts using CAD software. Assemble machine Parts by using CAD tool. Generate detailed drawing views. Create surface features using surfacing tools.
	Comprehensive Exam-III	**ME3612**	1. Comprehend the knowledge gained in the course work. 2. Demonstrate the ability in problem solving.
	Aptitude Training-I	**SH3032**	1. Develop a thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning problems. 2. Understand usage of basic aptitude terms of percentages, averages, ratios and applications of business aptitude terms of profits and interests 3. Develop a bridge in analogies, series and visualizing directions. 4. Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams.
	Summer Internship (4 Weeks)	**ME3632**	1. Verify the Technical knowledge in real industrial situations. 2. Develop interpersonal communication skills 3. Discuss activities and functions of the industry in which the internship has done 4. Write technical report.
	Indian Constitution	**SH301** :	1. Create awareness about law depiction and importance of Constitution

			2. Define Fundamental Rights and Fundamental Duties of the Indian Citizen to instill morality, social values, honesty, dignity of life and their social Responsibilities. 3. Create Awareness of their Surroundings, Society, Social problems and their suitable solutions while keeping rights and duties of the citizen keeping in mind. 4. Recognize distribution of powers and functions of Local Self Government. 5. Comprehend the National Emergency, Financial Emergency and their impact on Economy of the country.

Semester	Course	Course Code	Course Outcome
Semester VI	**Machine Design**	**ME3022**	**1.** Design machine components subjected to fluctuating loads
			2. Design gears for various applications
			3. Apply principles of interaction of materials processing and design.
			4. Select rolling contact and sliding contact bearing for given machine.
			5. Design machine components subjected to fluctuating loads
			6. Design gears for various applications
	Engines and Refrigeration	**ME3042**	1. Differentiate SI and CI engine and cycles and Calculate the design and operating parameters of fuel-supply system mixture requirements in engine
			2. Explain the stages of combustion in si and ci engines and effect of various operating parameters on combustion
			3. Explain methods of measurement of different performance parameters and prepare heat balance sheet and identify alternative fuels and compare different pollution norms
			4. Illustrate and analyze the performance of various the refrigeration system.
			5. Plot various refrigeration and air conditioning processes using charts and tables.
			Design air-conditioning system for various applications
	Biology for Engineers	**SH302**	7. Apply biological engineering principles, procedures needed to solve real-world problems
			8. Demonstrate the functions of biological systems
			9. Analyze biological phenomena with math and physics to gain important insights
			10. Explain working of different biomedical instruments
			11. Select the sensors for given biological applications
			Explain relevant aspect of movement control process
	Thermal Engineering Lab-III	**ME3522**	1. Perform testing on I C Engines and refrigeration and Air conditioning systems
			2. Analyze effect of different variables on performance of systems.
			Test the engine emissions and compare with BS norms.
	Software Training-I	**ME3542**	1. Use software effectively related to design/manufacturing and synthesis of mechanical systems and components.
			Develop solution for the mechanical engineering problem using program/software
			1. Comprehend the knowledge gained in the course work.

	Comprehensive Exam-IV	**ME3562**	2. Demonstrate the ability in problem solving.
			1. Acquire the requisite skills to deal with social issues through innovative and sustainable solutions considering technical, safety and environmental issues.
			2. Apply the principles of design and analysis of mechanical systems/processes to solve critical problems.
			3. Translate the design into the product, process, or system, including manufacturing, coding, testing and validation.
			4. Participate in team work, take responsibilities and develop decision making skills to become effective and creative leaders.
			Write technical report and communicate effectively
	Aptitude Training-II	**SH3042**	1. Develop a thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning Problems
			2. Understand usage of aptitude terms of speed, time and distance and permutations, probabilities and applications.
			3. Understand blood relations and ways of seating arrangements along with various geometrical figures
			4. Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams.
			5. Develop a thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning Problems
			Identify and communicate solution to problems (oral, visual, written) effectively.
			Device a project within a given time frame.

Semester	**Course**	**Course Code**	**Course Outcome**
Semester VII	**Industrial Engineering**	**ME4013**	**1.** Apply various methods of method study and time study to improve productivity. **2.** Use value analysis technique in engineering projects. **3.** Select the plant location and design appropriate type of layout along with material handling system. **4.** Plan production activities using tools like capacity and aggregate planning **5.** Design the inventory system using appropriate inventory model **6.** Implement project management knowledge, tools and techniques to achieve project success.
	Industrial Engineering and Quality Control Lab	**ME4512**	**1.** Perform work and method study at given work station by using suitable industrial engineering tools. **2.** Design the work system for the given application **3.** Apply inventory management principles for controlling the inventory **4.** Conduct process capability analysis **5.** Use modern tools and techniques for solving industrial engineering problems.

	Advanced Machining Lab.	**ME4532**	**1.** Develop CNC program and simulate it on CNC Simulation Software for a given job. **2.** Perform Set-up operation for CNC Turning Operations. **3.** Produce a job with given specifications on CNC Turning Machine. **4.** Perform Set-up operation for CNC Milling Operations. **5.** Produce a job with given specifications on CNC Milling Machine.
	Software Training-II	**ME4552**	**1.** Use simulation and analysis software in Mechanical Engineering. **2.** Develop solution for the Mechanical Engineering problems using simulation and analysis software.
	Capstone Project Phase II	**ME4732**	**1.** Select and apply appropriate design of experiments, experimental set up, models, or simulation technique for project task. **2.** Fabricate project or experimental set up, or model and analyze output of models/simulations to provide information for decisions **3.** Perform feasibility analysis and uses results to choose candidate solutions and evaluates quality of solutions to select the best one **4.** Collaborates with team members of diverse background and perspectives to achieve a common goal. **5.** Write technical report and communicate effectively.
	Engineering Acoustics	**ME4112**	**1.** Determine acoustic parameters in terms of decibel levels for pressure, power, intensity and impedance. **2.** Calculate sound levels by applying 1-d wave equation for air-borne and structure borne sound. **3.** Estimate absorption coefficient for different acoustic materials. **4.** Measure sound levels for mechanical systems and reduce it up to audible range by using suitable method.
	Material Handling Systems	**ME4132**	**1.** Explain the flow and type of movement of industrial goods **2.** Apply general rules for the type of movement, and **3.** Identify the appropriate material handling systems to suit the said requirement **4.** Explain current trends in material handling.
	Machine Tool Design	**ME4152**	**1.** Select & design proper transmission system for machine tool **2.** Decide layout of machine tool **3.** Select proper speed & feed boxes & design the same. **4.** Design machine tool structure-Bed, Columns & Housings, Select & Design Guide ways & slide ways, spindle. **5.** Determine dynamic characteristics of machine tool & carry stability analysis using FEA **6.** Design control systems in machine tools and SPM.
	Process Equipment Design	**ME4172**	**1.** Apply the role of design engineer in designing procedures of various process equipments. **2.** Design important components like flange couplings, heat transfer equipments, Distilation columns, absorber, extractor **3.** Develop a heat exchanger data sheet and test the design for safety.

			4. Design storage vessels, pressure vessels and various parts of vessels to apply key criteria involved in the design of internal pressure vessels as per IS Code **5.** Develop relationship between equipment design, safety and environment.
	Cryogenics	**ME4192**	**1.** Summarize the applications of low temperature engineering in various fields. **2.** Discuss the properties of materials and cryogenic fluids at low temperature. **3.** Compare cryogenic Liquefaction systems. **4.** Describe Cryogenic Refrigeration and Measurement Systems. **5.** Calculate performance of gas separation systems. **6.** Explain the methods of fluid storage, transfer, insulation and vacuum technology in cryogenics.
	Cogeneration & Waste Heat Recovery	**ME4212**	**1.** Summarize energy scenario and the need for energy conservation. **2.** Illustrate various techniques of waste heat recovery. **3.** Describe the various methods of cogeneration. **4.** Explain the various measures for energy conservation and financial implications for various thermal utilities.
	Industrial Automation and Robotics	**ME4232**	**1.** Explain manufacturing automation. **2.** Analyse transfer lines for its efficiency and effect of break downs **3.** Analyse automated assembly lines for its efficiency and effect of defective components **4.** Analyse forward and reverse kinematics of robot. **5.** Perform economic analysis of robot
	Production and Operations Management	**ME4252**	**1.** Select appropriate production and operation strategies based on situation **2.** Plan the capacity based on the demand pattern and prepare the manufacturing schedule based on the production plan. **3.** Apply lean tools for manufacturing and services operations. **4.** Implement recent production management trends like just in time philosophy and lean manufacturing in manufacturing field. **5.** Apply engineering economics principles for managing production function.
	Mechanical Vibrations	**ME4312**	**1.** Define and use the fundamental terms of vibration in design. **2.** Find natural frequencies and mode shapes of 2DOF and Multi DOF systems. **3.** Describe methods of vibration control. **4.** Select instrument and transducers for vibration measurement **5.** Analyze and interpret vibration data.
	Experimental Mechanics	**ME4332**	1. Determine stresses and strains in machine component by using photelasticity 2. Use of coating methods to determine strains and stresses 3. Apply strain gauge technique to determine strains and stresses in machine component
	Automobile Engineering	**ME4352**	**1.** Explain anatomy of an automotive vehicle with location of different parts and systems **2.** Expound various configurations of transmission systems and auxiliary components **3.** Compute different performance parameters of an automobile

			4. Differentiate between various types of braking system with its specific features **5.** Explain various steering and suspension system. **6.** Elucidate working of automotive electronic components and electrical systems
	Solar Energy	**ME4372**	**1.** Explain energy scenario and necessity of solar energy. **2.** Illustrate basics of solar radiation. **3.** Explain effect of solar energy transmission on various structures / surfaces. **4.** Design and compare solar collectors. **5.** Write different application of solar energy **6.** Explain various solar electric conversion systems.
	Mechatronics System Design	**ME4392**	**1.** Demonstrate the importance of integration of Mechanical, Electronics, computers and control in the design of Mechatronics system. **2.** Describe/identify key elements of sensors and transducers and techniques of interfacing with PLC, Microprocessor, Microcontroller etc. **3.** Apply a systematic approach to the design process for Mechatronics systems. (Concurrent engineering). **4.** Create system modeling of basic models and analyze. **5.** Demonstrate the practical application of mechatronics systems in areas such as manufacturing, automobile systems and robotics. **6.** Develop the capacity to think creatively and independently about new design problems and challenges.
	Manufacturing Simulation	**ME4412**	**1.** Explain concepts of modeling and simulation **2.** Develop model frameworks for discrete-event simulation **3.** Analyze input and output data of simulation model. **4.** Construct software models for manufacturing, logistic and material handling problems **5.** Develop Simulation model for a system and verify and validate the model.
	Mechanical Vibrations Lab	**ME4592**	**1.** Estimate natural frequencies and mode shapes of given machine component. **2.** Find modal parameters of vibratory system. **3.** Control the vibration by using principle of DVA. **4.** Use vibration measurement technique for fault diagnosis and machinery health monitoring
	Experimental Mechanics Laboratory	**ME4612**	**1.** Use of transmission polariscope for measurement of stresses in machine components. **2.** Apply reflection polariscope technique for measurement of strain/stress in photoelastic coating. **3.** Use strain gauge technique in various applications.
	Automobile Engineering Lab	**ME4632**	**1.** Explain the structure of an automobile. **2.** Describe and Design transmission systems of an automobile. **3.** Demonstrate and select different types of an automobile systems. **4.** Test wheel balancing and wheel alignment. **5.** Model any automobile system/component
	Solar Energy Lab	**ME4652**	1. Measure solar radiation using instruments. 2. Compare solar energy collection systems. 3. Design the applications of solar energy 4. Simulate the applications of solar energy 5. Analyze the performance of PV systems.
	Mechatronics System Lab	**ME4672**	**1.** Demonstrate/select proper types of sensors/transducers for given task.

			2. Design signal conditioning circuits for various signal conditioning processes like signal level change, signal form change, filters, bridge circuits etc. **3.** Demonstrate ability of control and automation of simple devices such as motors, cylinders using PLC. **4.** Demonstrate the ability to create microcontroller programs and properly interface them to input and output devices.
	Manufacturing Simulation lab	**ME4692**	**1.** Describe the nature of discrete-event simulation and the types of simulation models. **2.** Illustrate the broad applicability of discrete-event simulation to solve basic manufacturing systems problems. **3.** Design model considering as per constraints given. **4.** Simulate the essential steps of the simulation methodology & interpret the results.
	Condition Monitoring	**ME4752**	**1.** Apply maintenance schemes in industries. **2.** Monitor condition of rotating machinery using signature, temperature and corrosion analysis. **3.** Apply oil analysis technique to diagnose the wear debris. **4.** Apply modern technologies for effective plant maintenance.
	Aircraft Conceptual Design	**ME4772**	**1.** Understand the design process of aircraft and decide the aircraft configuration. **2.** Choose type of powerplant as per flight regime. **3.** Decide the fuselage layout as per type of aircraft. **4.** Design the wing for type of aircraft and its wing loading. **5.** Accurately evaluate lift, drag and mass for design synthesis process. **6.** Examine the influence of various design requirements on the configuration of an aircraft to derive an optimized design.
	Mechanical System Design	**ME4792**	**1.** Select brake and clutch based on functional requirements of automobile transmission systems. **2.** Calculate the stresses induced in pressure vessel subjected to various types of loading **3.** Apply design principles and obtain suitable dimensions for IC Engine components. **4.** Design the flat belt conveyor systems for suitable applications. **5.** Design the machine tool gear box for different speeds and torques at driven shaft. **6.** Apply statistical considerations for design.
	Rotor Dynamics	**ME4812**	**1.** Model the Rotor bearing systems and formulate the governing equations. **2.** Describe the role of damping, stiffness and inertia effects. **3.** Compute the critical speeds and stability limits. **4.** Analyze the rotors using transfer matrix method. **5.** Compute the transient response of rotors.
	Computational Fluid Dynamics	**ME4832**	**1.** Derive governing equations for fluid dynamics and heat transfer. **2.** Implement different techniques for discretization of governing equations **3.** Apply different CFS tools for real field complex problem **4.** Select appropriate grid generation methods for CFD analysis **5.** Modify the available schemes and methods for multi-physics problem **6.** Develop suitable simple numerical model for given application

	Air Conditioning system	**ME4852**	**1.** Determine cooling load on the system by considering various heat sources **2.** Select suitable air distribution method, distribution outlet and inlet, and fan. **3.** Select and design the suitable ventilation system for the commercial applications.
	Hybrid & Electrical Vehicles	**ME4872**	**1.** Understand the need of hybrid vehicles in today's context. **2.** Understand working of Electric Vehicles and recent trends. **3.** Describe design steps of a hybrid electric vehicle for given requirements. **4.** Explain hybrid drive trains. **5.** Discuss different Energy sources and drives required for hybrid vehicles. **6.** Discuss fuel cell technology for hybrid vehicle application.
	Total Quality Management	**ME4892**	**1.** Evaluate the principles of quality management and to explain how these principles can be applied within quality management systems. **2.** Identify the key aspects of the quality improvement cycle and to select and use appropriate tools and techniques for controlling, improving and measuring quality. **3.** Critically appraise the organizational, communication and teamwork requirements for effective quality management. **4.** Critically analyze the strategic issues in quality management, including current issues and developments, and to devise and evaluate quality implementation plans.
	Micro-Electro Mechanical System	**ME4912**	**1.** Explain the micro-fabrication method for MEMS systems **2.** Explain the principle behind the operation of MEMS systems. **3.** Choose suitable sensors and actuators for given application **4.** Analyze the different techniques in MEMS technology **5.** Design a MEMS system as per the application

- **Department Name: Mechanical Engineering Department**
- **PG Program Name: M. Tech Design Engineering**
- **Vision:**

  To transform the department into center of excellence by synergizing teaching, learning and research to produce globally competent, innovative and entrepreneurial Mechanical Engineers

- **Mission**

- To develop state-of–the-art facilities to stimulate faculty, staff and students to create, analyze, apply and disseminate knowledge.

- To build the competency to transform students into globally competent mechanical engineers by imparting quality education.

- To collaborate with research organizations, reputed educational institutions, industries and alumni for excellence in teaching, research and consultancy practices

Sr. No.	Program Outcomes
7.	Independently carry out research /investigation and development work to solve practical problems.
8.	Write and present a substantial technical report/document
9.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
10.	Accomplish collaborative and multi-disciplinary scientific research with consideration of professional, legal, and ethical issues.
11.	Manage the projects and its financial aspects on the strength of engineering knowledge and management principles.
12.	Engage in lifelong learning to address contemporary issues through independent and reflective learning.

Programme Educational Objective (PEO):

PEO1: - Students will apply knowledge of design engineering to pursue successful career in the field of Mechanical Engineering.

PEO2: - Students will become innovators, entrepreneurs to design and develop products and services to address social, technical and business challenges.

PEO3: - Students will engross in lifelong learning such as higher studies, research and other continuous professional development activities.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	I	MDE1014	Advanced Solid Mechanics	Co:1 Analyze stresses and strains at a point. Co:2 Model and analyze mechanical structures using energy methods. Co:3 Apply different analogies in torsion Co:4 Analyze and determine pressurized cylinders and rotating disks problems under loading. Co:5 Solve the problems in contact stresses. Co:6 Design a component considering plasticity effect
2.	I	MDE1024	Finite Element Methods	Co:1 Apply the concept of finite element method for solving machine design problems. Co:2 Formulate and solve manually problems in 1-D structural systems involving bars, trusses, beamsand frames. Co:3 Develop 2-D FE formulations involving triangular, quadrilateral elements and higher order elements. Co:4 Apply the knowledge of FEM for stress analysis, model analysis, heat transfer analysis, flow analysis and nonlinear analysis
3.	I	MDE1034	Computer Aided Design	Co:1 Describe the principles of CAD systems, the implementation of these principles, and its connections to CAM and CAE systems. Co:2 Demonstrate 2D, 3D transformations and projection transformations. Co:3 Describe various approaches of geometric modeling. Co:4 Represent 2D and 3D entities mathematically
4.	I	MDE1044	Mechanics of Composite Materials (Programme Elective - I)	Co:1 Student will be able to understand the basic concepts and difference betweencomposite materials with conventional materials. Co:2 Students will be able to understand role of constituent materials in defining theaverage properties and response of composite materials on macroscopic level. Co:3 Students will be able to apply knowledge for finding failure envelopes and stress-strain plots of laminates. Co:4 Students will be able to develop a clear understanding to utilize subject knowledgeusing computer programs to solve problems at structural level.
5.	I	MDE1054	Design for Manufacturing & Assembly (Programme Elective - I)	Co:1 Recognize the importance of selection of proper manufacturing process and its influence on new product development process and understand the interrelationship between product design and production methods for improving product performance during stage of design itself. Co:2 Identify the factors contributing reduction in assembly time and understand to incorporate assembly & disassembly guidelines in product design.

				Co:3 Utilize reliability concepts, failure analysis tools and techniques and accelerated life testmethods for improving product life cycle. Co:4 Understand the factors controlling cost and time required for the product maintenance and utilize this information for design for maintenance.
6.	I	MDE1064	Experimental Mechanics (Programme Elective - I)	Co:1 Determine direction and magnitude of principal stresses by using various techniques ofExperimental Stress Analysis. Co:2 Solve two and three dimensional problems of stress-strain analysis in mechanical engineering. Co:3 Formulate solutions to general image processing problems
7.	I	MDE1074	Reliability Engineering (Programme Elective - I)	Co:1 Apply the concepts of reliability, common reliability functions, parameters and methodsof their modeling and prediction. Co:2 Identify importance of statistical distributions for modeling failure data, and the physicalmeanings of model parameters. Co:3 Estimate reliability functions and parameters of an item using life testing, Weibull andhazard plotting, stress-stress analysis, and relevant reliability databases. Co:4 Estimate reliability functions and parameters of product/component systems usingreliability block diagram, fault tree and event tree. Co:5 Evaluate maintainability and availability of product/component systems, and different maintenance strategies.
8.	I	MDE1084	Advanced Engineering Materials (Programme Elective - II)	Co:1 Analyze the importance of various engineering materials (metals, polymers,ceramics, composites, Semi-conductor). Co:2 Recite polymers, ceramics and composites, their manufacturing techniques,properties and applications. Co:3 Propose appropriate ceramics, glass, plastics and polymers for different applications. Co:4 Understand and apply Electrical, Thermal, Optical and Magnetic Properties ofmetals, ceramics, polymers and composites for various applications. Co:5 Adapt economic considerations in usage and recycling of materials in human use. Co:6 Apply nano materials and nanocomposites for various applications.
9.	I	MDE1094	Tribology (Programme Elective - II)	Co:1 Determine tribological parameters of mechanical systems analytically by using suitabletheories of friction and theories of wear. Co:2 Select hydrostatic step bearing for real life application in mechanical engineering basedon axial load applied and lubricant available. Co:3 Calculate the maximum load carrying capacity and pressure equation for hydrodynamicthrust bearing by using engineering principles. Co:4 Evaluate elastohydrodynamic lubrication occurred in gears, cams and rolling elementbearing by using hertz and ertel-grubin equation.

				Co:5 Estimate pressure distribution in gas lubricated bearings by applying reynolds equationfor gas lubrication within elastic limits.
10.	I	MDE1104	Advanced Mathematical Methods inEngineering (Programme Elective - II)	Co:1 Evaluate Fourier Series and Fourier Transforms for given function and apply it tosolve the partial differential equations in Engineering problems. Co:2 Apply the specific method of solution of partial differential equations for solving thegiven problems. Co:3 Formulate and solve a boundary value problem (Partial differential equation,boundary. Co:4 Use the relevant method for solving the simultaneous linear equations and computethe Eigen values. Co:5 Estimate numerically the solution of given algebraic equation. Co:6 Analyze the variance and explain the different research designs.
11.	I	MDE1114	Smart Materials (Programme Elective - II)	Co:1 Describe the behaviour and applicability of various smart materials. Co:2 Demonstrate knowledge of the physicalprinciples underlying the behavior of smart materials. Co:3 Describe the basic principles and mechanisms of the stimuli-response for the most important smart materials. Co:4 Design simple models for smart structures & materials.
12.	I	MDE1124	Design Engineering Lab-I	Co:1 Solve 1D, 2D and 3D structural analysisproblems using the ANSYS software Co:2 Evaluate dynamic behavior of components Co:3 Appraise Linear buckling concept in Design of members which are succumbed to buckling Co:4 Solve structural analysis problems subjected to fatigue load. Co:5 Apply geometric and material nonlinearity while designing the components Co:6 Appraise steady state and transient thermal concept in design of members
13.	I	MDE1134	Advanced Stress Analysis Lab	Co:1 Determine and analyze the stresses and strains in machine component. Co:2 Analyze the stresses and strains on combined bending and torsion. Co:3 Experiment on demonstration of photoelastic techniques. Co:4 Calibration of the photoelastic constant, determination of the stress field in a beam under bending. Co:5 Determine stress and strain fields using DIC

14.	I	SHP551	Technical Communication	Co:1 Acquire skills required for good oral and written communication. Co:2 Demonstrate improved writing and readingskills. Co:3 Ensure the good quality of oral and written communication
15.	II	MDE1144	Mechanical Vibrations	Co:1 Derive and interpret equation of motions of multi-degrees of freedom systems. Co:2 Derive and interpret equation of motions of continuous systems. Co:3 Select suitable instrument and transducers for vibration measurement. Co:4 Derive and interpret response of the system subjected to Transient vibrations. Co:5 Analyze the systems with Non-linear vibrations
16.	II	MDE1154	Advanced Design of Mechanisms	Co:1 Deduce the four bar coupler point curves. Co:2 Design mechanism in given application to meet certain motion specifications. Co:3 Synthesize various mechanisms by using geometric method, algebraic methods and complex number method. Co:4 Analyze complex mechanism by using graphical methods.
17.	II	MDE1164	Engineering Acoustics (Programme Elective - III)	Co:1 Determine acoustic parameters in terms of decibel levels for pressure, power, intensity andimpedance. Co:2 Calculate sound levels by applying 1-D wave equation for air-borne and structure borne sound. Co:3 Estimate absorption coefficient for different acoustic materials. Co:4 Measure sound levels for mechanical systems and reduce it up to audible range by using suitable method.
18.	II	MDE1174	Fracture Mechanics (Programme Elective - III)	Co:1 Explain the mechanism of fracture in ductile and brittle materials Co:2 Explain the micro mechanisms of brittle and ductile fracture Co:3 Analyze the fatigue and fracture behavior of materials. Co:4 Apply the knowledge for failure analysis and case studies Co:5 Estimate crack tip opening displacement (CD) and J-integral.
19.	II	MDE1184	Product Designand Development (Programme Elective - III)	Co:1 Explore and analyze product development processes used in product design and development. Co:2 Identify and apply various product development techniques. Co:3 Analyze, evaluate and apply design consideration like concurrent engineering, aestheticand ergonomical for industrial product design. Co:4 Apply different methods, tools and technique to create new product design for consumer product.

20.	I	MDE1194	Rapid Manufacturing Techniques (Programme Elective - III)	Co:1 Identify suitable time compression techniquesfor rapid product development. Co:2 Model complex engineering products and develop process plans for rapid production. Co:3 Analyze and select a rapid manufacturing technology for a given component. Co:4 Identify the errors during generation of STL files and minimize them. Co:5 Optimize FDM process parameters to improve the quality of the parts.
21.	II	MDE1204	Rotor Dynamics (Programme Elective - IV)	Co:1 Model the Rotor bearing systems and formulate the governing equations. Co:2 Describe the role of damping, stiffness and inertia effects. Co:3 Compute the critical speeds and stability limits. Co:4 Analyze the rotors using transfer matrix method Co:5 Compute the transient response of rotors.
22.	II	MDE1214	Design for Optimization (Programme Elective - IV)	Co:1 Identify and apply mathematical models in optimization method. Co:2 Recognize the suitable method of optimization in non linear programming with and withoutconstraints. Co:3 Apply optimization method for staticapplications like shafts and springs. Co:4 Design dynamic applications like linkage mechanism by using optimization method. Co:5 Use genetic algorithm, ANN and Fuzzy logic to optimize various design parameters.
23.	II	MDE1224	Robotics (Programme Elective - IV)	Co:1 Comprehend basic terminologies and concepts associated with Robotics and Automation Co:2 Demonstrate comprehension of various Robotic sub-systems Co:3 Compute kinematics and dynamics to explain exact working pattern of robot Co:4 Design and select robots for Industrial and Non -Industrial applications
24.	II	MDE1234	Multi-Body Dynamics (Programme Elective - IV)	Co:1 Derive equations of motion for interconnected bodies in multi-body systems with three dimensional motion. Co:2 Implement and analyze methods of formulating equations of motion for interconnected bodies. Co:3 Write programs to solve constrained differential equations for analyzing multi-body systems. Co:4 Simulate and analyze all types of static and dynamic behaviors of the multi-body systems. Co:5 Lead team projects in academic research or the industry that require modeling and simulation of multi-body systems Co:6 Demonstrate an improved technical writing and presentation skills.
25.	II	MDE1244	Research Methodology & IPR	Co:1 Formulate a research problem. Co:2 Analyze research related information. Co:3 Prepare and present research proposal/paper by following research ethics. Co:4 Make effective use of computers and computing tools to search information, analyze informationand prepare report

				Co:5 Describe nature and processes involved in development of intellectual property rights
26.	II	MDE1254	Design EngineeringLab-II	Co:1 Apply basics of MATLAB programming for Engineering applications. Co:2 Compute differentiation of single variable using MATLAB. Co:3 Solve Numerical Integration problems using MATLAB. Co:4 Solve Linear and Non Linear equations using MATLAB. Co:5 Solve Linear Least Square Regression problems using MATLAB. Co:6 Solve Ordinary Differential Equation using MATLAB
27.	II	MDE1264	Vibration and Acoustics Laboratory	Co:1 Estimate natural frequency, damping factor, modal density of given component experimentally Co:2 Extract experimental mode shapes of plates Co:3 Predict fault of machine by vibration and sound measurement
28.	II	MDE1274	Mini Project	Co:1 Identify structural engineering problems reviewing available literature. Co:2 Study different techniques used to analyze complex structural systems. Co:3 Work on the solutions given and present solutionby using his/her technique applying engineering principles
29.	II	MDE1284	Seminar	Co:1 Survey the literature such as books, national/international refereed journals and contact resource persons for the selected topic of Seminar. Co:2 Learn to write technical reports. Co:3 Develop oral and written communication skillsto present and defend their work in front of Department Post Graduate Committee.
30.	III	MDE2014	Industry Internship	Co:1 Identify the real applications and practices of courses studied, at industry level Co:2 Recognize various modeling, analysis andvalidation techniques adopted at industries Co:3 Demonstrate the issues at design, manufacturing and assembly level Co:4 Summarize and present technical data in report format
31.	III	MOE2010	Artificial Intelligence – Machine Learning	Co:1 Describe central machine learning methods and techniques and how they relate to artificial intelligence Co:2 Differentiate between supervised and unsupervised learning techniques Co:3 Apply the ML algorithms to a real-world problem Co:4 Optimize the models learned and report on the expected accuracy that can beachieved by applying the models. Co:5 Evaluate a given problem and applyappropriate machine learning technique
32.	III	MOE2020	Creative Thinking: Tools& Techniques	Co:1 Comprehend importance in tackling global challenges as well as in everyday problem-solving scenarios Co:2 Apply different brainstorming techniques in group activities

				Co:3 Be proficient in the application of the 6 thinking hats tool in different life scenarios Co:4 Develop a systematic approach to idea generation through the use of morphological analysis Co:5 Innovate on an existing product, service or situation applying the SCAMPER method Co:6 Get confident with the theory of inventiveproblem solving, called TRI Co:7 Select and apply the appropriatetechnique based on the opportunity to seize or the problem to tackle
33.	III	MOE2030	MOOC Course	Co:1 Identify the real application and practices of the courses studied, at the industry level. Co:2 Recognize various modeling ,analysis and validation techniques adopted at industries. Co:3 Demonstrate the issue at design,manufacturing and assembly level
34.	III	MOE2040	Condition Monitoring andSignal Processing	Co:1 Identify the maintenance scheme, their scope and limitations – apply the maintenance strategies to various problems in the industrial sectors. Co:2 Analyze for machinery condition monitoring and explain how this compliments monitoring the condition Co:3 Develop an appreciation for the need of modern technological approach for plant maintenance to reduce the maintenanceexpenditure. Co:4 Emphasizes on case studies that require gathering information using the moderntesting equipment and processing it to identify the malfunction in that system. Co:5 Identify vibration measurement,lubrication oil analysis.
35.	III	MOE2050	Aircraft Conceptual Design	Co:1 Understand the design process of aircraft and decide the aircraft configuration. Co:2 Choose type of power plant as per flight regime. Co:3 Decide the fuselage layout as per type of aircraft. Co:4 Design the wing for type of aircraft andits wing loading. Co:5 Accurately evaluate lift, drag and massfor design synthesis process. Co:6 Examine the influence of various design requirements on the configuration of an aircraft to derive an optimized design.
36.	III	MDE2024	DissertationStage-I	Co:1 Explain the contributions of various researchers in the field of design engg after carrying out literature survey from reputed journals Co:2 Recognize the gap in the research and define a problem statement Co:3 Explain significance and applicability of problem statement Co:4 Summarize and present technical data in report format
37.	III	MDE2034	DissertationStage-II	Co:1 Outline the work plan for problem statement Co:2 Identify the proper modelling and analysis tool Co:3 Reproduce the preliminary results of problem statement Co:4 Summarize and present technical data in report format

38.	IV	MDE2044	DissertationStage-III	Co:1 Explain the issues related to method adopted in solving the problem Co:2 Select proper technique in solving the problem Co:3 Compare the results with available literature
39.	IV	MDE2054	DissertationStage-IV	Co:1 Design new methodology to address the problem Co:2 Justify the results obtained from new methodology Co:3 Write technical report and defend work

Department Name :-Mechanical Engineering

- **PG Program Name:-Mechanical Manufacturing Engg.**

Vision:

To transform the department into center of excellence by synergizing teaching, learning and research to produce globally competent, innovative and entrepreneurial Mechanical Engineers

Mission

- To develop state-of–the-art facilities to stimulate faculty, staff and students to create,analyze, apply and disseminate knowledge.
- To build the competency to transform students into globally competent mechanical engineersby imparting quality education.
- To collaborate with research organizations, reputed educational institutions, industries andalumni for excellence in teaching, research and consultancy practices

Sr. No.	Program Outcomes
1.	An ability to independently carry out research /investigation and development work to solve practical problems
2.	An ability to write and present a substantial technical report/document
3.	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
4.	To accomplish collaborative and multi-disciplinary scientific research with consideration of professional, legal, and ethical issues.
5.	Manage the projects and its financial aspects on the strength of engineering knowledge and management principles.
6.	Engage in lifelong learning to address contemporary issues through independent and reflective learning.

Programme Educational Objectives for the M. Tech Mechanical Manufacturing Engg.

PEO1: - Graduates will apply knowledge of manufacturing engineering to design, model,simulate and solve problems to develop most efficient manufacturing systems to pursuesuccessful career in the field of Mechanical Engineering.

PEO2: - Graduates will have technical competency in thermal engineering or related areas to become innovators, academicians and provide services to address technical, business and social challenges

PEO3: - Graduates will engage in lifelong learning such as higher studies, research and other continuous professional development activities.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	I	SHP5131	Advanced Mathematical Methods in Engineering	Co:1 Evaluate Fourier series for given function and apply it to solve the partial differential equations in Engineering problems.

				Co:2 Apply the specific method of solution of partial differential equations for solving thegiven problems Co:3 Formulate and solve a boundary value problem(Partial differential equation, boundary and initial conditions). Co:4 Use the relevant method for solving the simultaneous linear equations and compute theEigen values. Co:5 Estimate numerically the solution of given algebraic equation. Co:6 Analyze the variance and explain the different research designs.
2.	I	MMF101	AdditiveManufacturing for Industry 4.0	Co:1 Describe the Importance of AM technologies in Manufacturing Co:2 Classify and select additive manufacturing processes for a given application. Co:3 Design for manufacture for AM and carry out Process Analysis Co:4 Point out the software issues addressed in the additive manufacturing process. Co:5 Identify the Different methods for Post-processing of AM parts Co:6 Suggest the Applications of AM in Automobile, Aerospace, and Bio-medical etc
3.	I	MMF102	Industrial Process Automation Systems	Co:1 Select appropriate automation technologies for process control system. Co:2 Design industrial process automation as per specifications of the customers Co:3 Analyze system performance.
4.	I	MMF1031	Advanced System components & Integration (Programme Elective – I)	Co:1 Identify hardware and software issues for system integration in process and manufacturing automation and be able to offer solutions. Co:2 Use engineering software tools such as VB & C++, .NET, NetDDE, OPC (including COM & DCOM), web services, HMI, DLLs and APIs. Co:3 Specify hardware and software components and functions of advanced systems such as robotics and vision, automated work cells, flexible manufacturing systems, and computer integrated manufacturing as related to plant wide automated system integration and IIoT. Co:4 Implementation of Fuzzy Logic and Neural Network Control Systems, and identify advantages, and disadvantages of such controllers. Co:5 Select state-of-the art advanced sensors and actuators for process and manufacturing automation systems. Co:6 Describe and apply wireless standards and applications used in industrial

				automation projects. Co:7 Apply process and machine safety standards in the design, integration and maintenance of process automation systems.
5.	I	MMF1041	Mechatronics System Design for Manufacturing (Programme Elective – I)	Co:1 Demonstrate the method and importance of integration of Mechanical, Electronics andControl in the design of mechatronics system. Co:2 Select key elements of sensors and transducers and interfacing the same with problem under consideration through PLC.
6.	I	MMF1051	IndustrialNetwork & Controllers (Programme Elective – I)	Co:1 Design Industrial Networking architecture. Co:2 Select networking technologies for industrial automation applications. Co:3 Follow I/O bus installation and wiring connections guidelines for setting up industrialnetworks. Co:4 Design, configure, and program fieldbus networks. Program the communication among industrial automation controllers.
7.	I	MMF106	Metal Cutting& Tool Design (Programme Elective – I)	Co:1 Analyze fundamental phenomena in metal cutting and grinding, through application of theprinciples of mechanics, materials, and allied engineering fields. Co:2 Develop quantitative and qualitative skills necessary to address practical issues pertainingto machining productivity and innovation and machine stability. Co:3 Design of press tools for given component.
8.	I	MMF107	Applied Data Analytics (Programme Elective – I)	Co:1 Explain need of Data analytics in real time application. Co:2 Apply ANOVA to the given data set. Co:3 Apply machine learning to the given data set. Co:4 Explain and apply different supervised learning techniques.
9.	I	MMF108	AdvancedManufacturing Technology (Programme Elective – I)	Co:1 Select appropriate process for manufacturing products. Co:2 Have appropriate degree of competency in the evaluation of various manufacturing technologies and their applications in modern manufacturing processes.
10.	I	MMF109	Finite ElementMethods in Manufacturing (Programme Elective – I)	Co:1 Apply finite element method to solve problems in solid mechanics. Co:2 Formulate FE characteristic equations for two dimensional elements and analyze plainstress, plain strain, axi-symmetric and plate bending problems. Co:3 Apply principles of FEM to solve heat transfer and fluid mechanics problems. Co:4 Analyze deformation processes using

				finite element principles
11.	I	MMF1101	Solidification Processes (Programme Elective – II)	Co:1 Design gating & Risering system for casting. Co:2 Select the proper advanced casting method. Co:3 Develop plastic shaping process for new product. Co:4 Select suitable manufacturing method for glass & rubber products. Co:5 Use appropriate welding technique as per application.
12.	I	MMF1111	DigitalProcess Control (Programme Elective – II)	Co:1 Design, model & tune digital PID controllers. Co:2 Analyze system variables using MATLAB/SIMULINK.
13.	I	MMF1121	Machine Vision & Applications (Programme Elective – II)	Co:1 Demonstrate image processing techniques. Co:2 Identify various stages in applying the technique.
14.	I	MMF1131	AdvancedMEMS Fabrication & Microfluidics	Co:1 Design MEMS device using basic planer & non-planer micro fabrication method. Co:2 Demonstrate use of various methods & techniques for microfluidics actuation control.
15.	I	MMF114	Industrial Surface Engineering	Co:1 Select the surface preparation methods suitable for different substrate materials. Co:2 Describe suitable method for testing &evaluation of metallic coatings. Co:3 Explain importance of specific coatings & its applications on specific Engineering Components. Co:4 Explain the effect of process parameters on the properties & microstructure ofThe Surface coating processes. Co:5 Describe the importance & role of surface modifications to achieve several Technological Properties.
16.	I	MMF115	Composite Materials & Processing	Co:1 Explain Manufacturing methods of composites. Co:2 Discuss the nature of various forms of composite reinforcement and matrix. Co:3 Select an appropriate processing method for variety of composite and products.
17.	I	MMF1161	SoftwareProficiency-I	Co:1 Develop/ select appropriate orientation of the casting & parting plane. Co:2 Calculate modulus of the casting & number of cavities in the mould. Co:3 Calculation of riser & gating system design.
18.	I	MMF1171	Manufacturing Simulation Lab	Co:1 Demonstrate the broad applicability of discrete-event simulation to solve complex manufacturing systems problems Co:2 apply the essential steps of the simulation methodology

				Co:3 Learn to use the WITNESS 13/Arena Simulation Software Tool to build credible valid simulation models, design and run simulation experiments, and critically evaluate decision- support simulation results. Co:4 Learn analytical techniques for interpreting input data and output results pertinent to simulation models. Co:5 Gain insight into system behavior by measuring the performance characteristics of proposednew manufacturing system or the impact of proposed changes for existing
19.	I	SHP5511	TechnicalCommunication	Co:1 Acquire skills required for good oral and written communication Co:2 Demonstrate improved writing and reading skills Co:3 Ensure the good quality of oral and written communication
20.	II	MMF201	Robotic &Automation	Co:1 Evaluate the different mechanical configurations available for a modern industrial robot. Co:2 Analyze complex robot kinematic theory and devise kinematic calculations for a given case study. Co:3 Program an industrial robot off-line using kinematic simulation software to performa specified task. Co:4 Appraise the impact of automation, both economic and social, on modern industryand future applications in industry.
21.	II	MMF202	Lean Six Sigma	Co:1 Explain Six Sigma Methodology Co:2 Generate process capability indices Co:3 Perform ANOVA Co:4 Perform regression analysis Co:5 Design experiments Co:6 Perform measurement system analysis
22.	II	MMF2031	Material Characterization & Failure Analysis (Programme Elective – III)	Co:1 Interpret various materials characterization techniques. Co:2 Select the characterization tool for specific application Co:3 Analyze the characterization results by various equipment
23.	II	MMF2041	System Modelling & Simulation (Programme Elective – III)	Co:1 Model any system from different fields. Co:2 Implement numerical algorithm to meet simple requirements, expressed in English Co:3 Discuss the simulation methods and select the suitable technique on the problems.
24.	II	MMF205	Polymer Processing & Die Design (Programme Elective – III)	Co:1 Demonstrate the key practical theory with the operation principles of polymer processing technologies and their potential limitations. Co:2 Select and justify appropriate processing technologies for specific applications. Co:3 Demonstrate the constructional features and working of basic elements in injectionmolds, extrusion and blow molding dies Co:4 Design the mold for optimum

				performance
25.	II	MMF206	ProductLife cycle Management (Programme Elective – III)	Co:1 Understand & explain the concept of PLM, set PLM Vision and Prepare PLM Strategy. Co:2 Plan for Integrated Product Development Process. Co:3 Plan for Collaborative Product Development Process. Co:4 Perform Product Structure Modelling with relationships between different components of the product and their versions. Co:5 Create Product Data & Manage it Co:6 Implement Digital Manufacturing Technique.
26.	II	MMF207	Metrology 4.0 (Programme Elective – III)	Co:1 Explain the basics of coordinate metrology as well as the application of the methods ofmechanical (tactile) and non-contact probing in 3D coordinate metrology. Co:2 Demonstrate the concept of reverse engineering Co:3 Use software to generate data for analysis
27.	II	MMF2081	SustainableManufacturing Processes (Programme Elective – IV)	Co:1 Understand the three pillars of sustainability and how they are manifested in sustainablemanufacturing. Co:2 Incorporate economic, environmental, and social aspects into decision making processesusing multi-criteria decision-making methods. Co:3 Identify the link between manufacturing process models and sustainable manufacturingmetrics for product and process improvement Co:4 Identify manufacturing system level sustainability issues and how they are linked withmanufacturing process level issues.
28.	II	MMF2091	Logistic &Supply Chain Management (Programme Elective – IV)	Co:1 Discuss and describe the key issues in SCM and logistic network. Co:2 Demonstrate Bullwhip effect in SCM and Develop physical distribution strategies Co:3 Decide the location of warehouses and develop various inventory models based on riskand uncertainty.
29.	II	MMF210	Project Management for Industry4.0 (Programme Elective – IV)	Co:1 Discuss Project Management relevance in the context of IND4.0 Co:2 Evaluate the needs of an organization regarding IND 4.0, taking into account maturity /readiness models (Evaluate) Co:3 Plan, develop and manage projects in the context of IND 4.0, using frameworks of projectmanagement, such as PMI, IPMA and Agile/Lean. Co:4 Support team decision making processes in accordance with the contingencies and

				uncertain environments of IND 4.0.
30.	II	MMF211	Quality and Reliability (Programme Elective – IV)	Co:1 Explain the concept of design for Quality Co:2 Analyze the process and capability using various methods Co:3 Determine Process and measurement Systems Capability Co:4 Carry out reliability data analysis. Co:5 Apply various reliability prediction and evolution methods.
31.	II	MMF212	Optimization Techniques & Industrial Applications (Programme Elective – IV)	Co:1 Identify and apply mathematical models in optimization method. Co:2 Recognize the suitable method of optimization in non-linear programming with and withoutconstraints. Co:3 Apply optimization method for static applications like shafts and springs. Co:4 Design dynamic applications like linkage mechanism by using optimization method Co:5 Use genetic algorithm, ANN and Fuzzy logic to optimize various manufacturing systems
32.	II	MMF2131	Research Methodology & IPR	Co:1 Formulate research Co:2 Analyze research related information Co:3 Prepare and present research proposal/paper by following research ethics Co:4 Make effective use of computers and computing tools to search information, analyzeinformation and prepare report. Co:5 Describe nature and processes involved in development of intellectual property
33.	II	MMF2141	CAM Lab.	Co:1 Develop sketches using suitable CAD software. Co:2 Develop part models using suitable CAD software. Co:3 Develop Assembly model using suitable CAD software. Co:4 Develop 2D drawings using suitable CAD software. Co:5 Generate tool path and part program for plain milling operation.
34.	II	MMF2151	Software Proficiency-II	Co:1 Develop/ select appropriate model required for simulation. Co:2 Apply proper constraints and boundary conditions. Co:3 Select suitable solver settings of simulation software.
35.	II	MMF2161	Mini Project	Co:1 Identify structural engineering problems reviewing available literature. Co:2 Study different techniques used to analyze complex structural systems. Co:3 Work on the solutions given and present solution by using his/her technique

36.	III	MMF3011	Industry Internship	Co:1 Identify the real applications and practices of courses studied, at industry level Co:2 Recognize various modeling, analysis and validation techniques adopted at industries Co:3 Demonstrate the issues at design, manufacturing and assembly levels Co:4 Summarize and present technical data in report format.
37.	III	MOE2010	Artificial Intelligence – Machine Learning	Co:6 Describe central machine learning methods and techniques and how they relate to artificial intelligence Co:7 Differentiate between supervised and unsupervised learning techniques Co:8 Apply the ML algorithms to a real-world problem Co:9 Optimize the models learned and report on the expected accuracy that can beachieved by applying the models. Evaluate a given problem and applyappropriate machine learning technique
38.	III	MOE2020	Creative Thinking: Tools& Techniques	Co:8 Comprehend importance in tackling global challenges as well as in everyday problem-solving scenarios Co:9 Apply different brainstorming techniques in group activities Co:10 Be proficient in the application of the 6 thinking hats tool in different life scenarios Co:11 Develop a systematic approach to idea generation through the use of morphological analysis Co:12 Innovate on an existing product, service or situation applying the SCAMPER method Co:13 Get confident with the theory of inventiveproblem solving, called TRIZ Select and apply the appropriatetechnique based on the opportunity to seize or the problem to tackle
39.	III	MOE2030	MOOC Course	Co:4 Identify the real application and practices of the courses studied, at the industry level. Co:5 Recognize various modeling ,analysis andvalidation techniques adopted at industries. Demonstrate the issue at design,manufacturing and assembly level
40.	III	MOE2040	Condition Monitoring and Signal Processing	Co:6 Identify the maintenance scheme, their scope and limitations – apply the maintenance strategies to various problems in the industrial sectors. Co:7 Analyze for machinery condition monitoring and explain how this compliments monitoring the condition Co:8 Develop an appreciation for the need of modern technological approach for plant maintenance to reduce the maintenance expenditure. Co:9 Emphasizes on case studies that require gathering information using the modern testing equipment and processing it to

				identify the malfunction in that system. Identify vibration measurement,lubrication oil analysis.
41.	III	MOE2050	Aircraft Conceptual Design	Co:7 Understand the design process of aircraft and decide the aircraft configuration. Co:8 Choose type of power plant as per flight regime. Co:9 Decide the fuselage layout as per type of aircraft. Co:10 Design the wing for type of aircraft andits wing loading. Co:11 Accurately evaluate lift, drag and mass for design synthesis process. Co:4 Examine the influence of various design requirements on the configuration of an aircraft to derive an optimized design.
42.	III	MMF3031	Dissertation Phase-I	Co:1 contributions of various researchers in the field of design engg after carrying out literature survey from reputed journals Co:2 Recognize the gap in the research and define a problem statement Co:3 Explain significance and applicability of problem statement Co:4 Summarize and present technical data in report format.
43.	III	MMF3041	Dissertation Phase-II	Co:1 Outline the work plan for problem statement Co:2 Identify the proper modeling and analysis tool Co:3 Reproduce the preliminary results of problem statement Co:4 Summarize and present technical
44.	IV	MMF4011	Dissertation Phase-III	Co:1 Explain the issues related to method adopted in solving the problem Co:2 Select proper technique in solving the problem
45.	IV	MMF4021	Dissertation Viva-Voce	Co:1 Design new methodology to address the problem Co:2 Justify the results obtained from new methodology Co:3 Write the project report

Department Name :-Mechanical Engineering

- **PG Program Name :-Mechanical Thermal Engineering**

Vision:

To transform the department into center of excellence by synergizing teaching, learning and research to produce globally competent, innovative and entrepreneurial Mechanical Engineers

Mission

- To develop state-of–the-art facilities to stimulate faculty, staff and students to create,analyze, apply and disseminate knowledge.
- To build the competency to transform students into globally competent mechanical engineersby imparting quality education.
- To collaborate with research organizations, reputed educational institutions, industries andalumni for excellence in teaching, research and consultancy practices

Sr. No.	Program Outcomes
1.	To independently carry out research /investigation and development work to solve practical problems
2.	To write and present a substantial technical report/document
3.	To demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than therequirements in the appropriate bachelor program.
4.	To accomplish collaborative and multi-disciplinary scientific research with consideration of professional, legal, and ethical issues.
5.	To Manage the projects and its financial aspects on the strength of engineering knowledge and management principles.
6.	To Engage in lifelong learning to address contemporary issues through independent and reflective learning.

Programme Educational Objectives for the M. Tech Mechanical Thermal Engineering PEO1: - Graduates will apply concepts of thermal engineering to design, model, simulate andsolve problems to develop energy efficient systems to pursue successful career in the field ofMechanical Engineering and allied sciences.

PEO2: - Graduates will have technical competency in thermal engineering or related areas to become innovators, academicians and provide services to address technical, business and social challenges.

PEO3: - Graduates will involve in lifelong learning such as higher studies, research to maintain professionalism and ethical standards.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	I	SHP5131	Advanced Mathematical Methods in Engineering	Co:1 Evaluate Fourier series for given function and apply it to solve the partialdifferential equations in Engineeringproblems. Co:2 Apply the specific method of solution of partial differential equations for solvingthe given problems Co:3 Formulate and solve a boundary value problem (Partial differential equation, boundary and initial conditions). Co:4 Use the relevant method for solving the simultaneous linear equations and compute the Eigen values. Co:5 Estimate numerically the solution of given algebraic equation. Co:6 Analyze the variance and explain thedifferent research designs.
2.	I	MTE1011	Classical and Statistical Thermodynamics	Co:1 Explain different behavior of gases and thermodynamic relations Co:2 Interpret thermodynamics propertyrelations to various mixtures and solutions. Co:3 Compare thermodynamics equilibrium of system Co:4 Explain the kinetic theory of gases. Co:5 Apply the principle of statisticalthermodynamics to the various processes. Co:6 Develop and analyze the various thermodynamic cycles.

3.	I	MTE1022	Principles of Heat Transfer	Co:1 Analyze heat conduction and Radiation Co:2 Develop a solution to heat convection toexternal laminar flow Co:3 Formulate heat convection to internallaminar flow. Co:4 Examine heat convection in turbulentflow Co:5 Interpret convection with phase change Co:6 Solve heat transfer problem numerically
4.	I	MTE1031	Advanced Fluid Mechanics	Co:1 Explain basic concepts in the fluid mechanics. Co:2 Analyze practical problems of fluid flow. Co:3 Explain concepts of boundary layertheory. Co:4 Evaluate the performance of fluid flowdevices in laminar and turbulent flows. Co:5 Apply the concepts in the analysis offluid flow problems.
5.	I	MTE1041	Design of Pumps, Compressor and Blower	Co:1 Select suitable pump, blower, fan and compressor for a given application. Co:2 Design pump, blower, fan or compressorfor a given application. Co:3 Analyze the performance of compressorand pump Co:4 Model and simulate pump, blower, fanand compressor.
6.	I	MTE1051	Gas turbine andJet Propulsion	Co:1 Describe the ideal and real thermodynamic cycles of air-breathing engines and Industrial gas turbines. Co:2 Design the blading, study the velocity triangles and estimate the performance of centrifugal and axial flow compressors. Co:3 Explain the combustion process and design the combustion chamber of a gas turbine. Co:4 Design the blading, study the velocity triangles and estimate the performance of axial and radial in-flow turbines. Co:5 Analyze off-design performance andmatching of the components of a gas turbine.
7.	I	MET1061	Finite Element Method for Thermal Engineering (Program Elective-I)	Co:1 Establish the mathematical model for the complex analysis problems and predict the nature of the solution. Co:2 Formulate element characteristicmatrices and vectors. Co:3 Identify the boundary conditions and their incorporation into FE equation Co:4 Analyze simple geometry problems for Thermal and stress analysis. Co:5 Interpret the analysis results for the improvement or modification of the system.

8.	I	MTE1071	Hybrid & Electric Vehicles(Program Elective-I)	Co:1 Select suitable drive scheme fordeveloping an electric hybrid vehicle. Co:2 Design and develop basic schemes of electric vehicles and hybrid electric vehicles. Co:3 Choose proper energy storage systems, electric machine and drive train for vehicle applications. Co:4 Analyze various communication protocolsand technologies used in vehicle networks.
9.	I	MTE1081	Materials for Thermal System (Program Elective-II)	Co:1 Select suitable material for thermal systems Co:2 Justify use and suitability of thermalmaterials for different systems Co:3 Compose advanced materials for different application Co:4 Explain applications of thermal materials
10.	I	MTE1091	Solar Energy (Program Elective-II)	Co:1 Estimate and quantify available solarradiation Co:2 Design the components of solar energysystems. Co:3 Justify economics of the solar energysystems
11.	I	MTE1101	Power Plant Engineering Elective-II)	Co:1 Explain analytical and technological aspects of power plant design, systems and their effects. Co:2 Analyze and explain various power plants. Co:3 Summarize advanced power cycles. Co:4 Recognize environmental issues. Co:5 Estimate economics of power plants.
12.	I	MTE1111	Modeling Lab	Co:1 Model the components of thermal systemusing suitable software. Co:2 Create computational domain for selected geometry. Co:3 Generate mesh and refine mesh elements of given geometry.
13.	I	MTE1121	Thermal Engineering Lab-I	Co:1 Conduct test and interpret the theoretical and experimental data of conduction and convection experiments. Co:2 Relate the theory and the experimentation pertaining to thermal system. Co:3 Examine various thermal systems
14.	I	MTE1131	Computational Methods in Thermal Engineering Lab	Co:1 Develop codes for numerical methods totackle simple thermal problems Co:2 Simulate codes of computational methodsof given conditions Co:3 Analyze and validate output of writtencodes with analytical solution.

15.	I	SHP551	Technical Communication	Co:1 Acquire skills required for good oral andwritten communication Co:2 Demonstrate improved writing andreading skills Co:3 Ensure the good quality of oral andwritten communication
16.	II	MTE2011	Computational Fluid Dynamics	Co:1 Derive governing equations for fluid dynamics and heat transfer. Co:2 Develop finite difference algorithms forfluid flow and heat transfer problems. Co:3 Develop finite volume algorithms forfluid dynamics equations. Co:4 Select appropriate grid generationmethods for CFD analysis. Co:5 Apply different CFD Techniques tovarious fluid flow problems
17.	II	MTE2021	Design and Analysis of Thermal System	Co:1 Illustrate basic principles of modeling and optimization of design of thermal systems. Co:2 Design thermal systems. Co:3 Analyze thermal system.
18.	II	MTE2031	Design of Heat Transfer Equipment (Program Elective III)	Co:1 Select suitable heat exchanger forparticular application. Co:2 Design of heat exchanger. Co:3 Design and analyse boiler furnace. Co:4 Analyse different heat transfer equipments.
19.	II	MTE2041	Cryogenics Engineering (Program Elective III)	Co:1 Apply the basic principles of low temperature engineering. Co:2 Explain the behavior of solids and liquidat low temperatures Co:3 Analyze cryogenic systems. Co:4 Discuss gas separation systems. Co:5 Design Heat Exchangers for CryogenicSystem.
20.	II	MTE2051	Food Processing, Preservation and Transport (Program Elective III)	Co:1 Analyze mechanism of food spoilage Co:2 Design suitable food processing and preservation system Co:3 Select suitable cold storage system Co:4 Design and analysis transport system of preserved foods Co:5 Model the preservation system
21.	II	MTE2061	Battery Thermal Management System (Program Elective III)	Co:1 Illustrate major functions and parts of a battery-management system. Co:2 Design various configurations of batterypack and recent trends in battery pack. Co:3 Compute stored energy in a battery pack. Co:4 Measure and control current, temperatureand isolation in battery-management system

22.	II	MTE2071	Heating Ventilation Air Conditioning andRefrigeration Systems (Program Elective IV)	Co:1 Explain different vapor compressionrefrigeration system and refrigerants. Co:2 Design of cooling and heating components of refrigeration system Co:3 Explain fundamentals of air conditioning and estimate cooling load on the building by considering various heat sources Co:4 Illustrate various air conditioning systems. Co:5 Design ducting systems and select air distribution system. Co:6 Explain air handling units in various applications.
23.	II	MTE2081	Energy Audit and Management (Program Elective IV)	Co:1 Summarize energy scenario and the needfor energy conservation. Co:2 Conduct energy audit of a system Co:3 Illustrate various techniques of waste heat recovery and cogeneration. Co:4 Explain the various measures for energy conservation and financial implications for various thermal utilities.
24.	II	MTE2091	Cogeneration and Waste Heat Management (Program Elective IV)	Co:1 Estimate and quantify available wasteheat Co:2 Explore different waste heat recoverysystems Co:3 Explain economics of cogeneration andwaste heat recovery systems Co:4 Illustrate different cogenerationtechniques.
25.	II	MTE2101	Advanced Thermal StorageTechnology (Program Elective IV)	Co:1 Select thermal storage systems and thestorage materials Co:2 Develop a model and analyze the thermalstorage systems Co:3 Explain applications of thermal storagesystems
26.	II	MTE2111	Research Methodology & IPR	Co:1 Formulate a research problem. Co:2 Analyze research related information. Co:3 Prepare and present research proposal/paper by following research ethics. Co:4 Make effective use of computers and computing tools to search information, analyze information and prepare report. Co:5 Describe nature and processes involved in development of intellectual property rights
27.	II	MTE2121	Computational Fluid Dynamics Lab	Co:1 Formulate problems in fluid flow and heattransfer. Co:2 Apply initial and boundary conditions tosolve heat transfer problems. Co:3 Use ANSYS-Fluent for solving real life engineering problems
28.	II	MTE2131	Thermal Engineering Lab-II	Co:1 Evaluate COP of different refrigerationsystems. Co:2 Estimate cooling load needed for givenspace. Co:3 Design a refrigeration and air conditioning system for given application. Co:4 Calculate efficiency and effectiveness of different types of heat exchangers.

29.	II	MTE2141	Mini Project	Co:1 Solve a live problem using software/analytical/Experimental / computational tools. Co:2 Write technical reports. Co:3 Develop skills to present the findings.
30.	III	MTE3011	Industry Internship	Co:1 Identify the real applications and practicesof courses studied, at industry level Co:2 Recognize various modeling, analysis and validation techniques adopted at industries. Co:3 Demonstrate the issues at design, manufacturing and assembly levels. Co:4 Summarize and present technical data in report format.
31.	III	MOE2010	Artificial Intelligence – Machine Learning	Co:10 Describe central machine learning methods and techniques and how they relate to artificial intelligence Co:11 Differentiate between supervised and unsupervised learning techniques Co:12 Apply the ML algorithms to a real-world problem Co:13 Optimize the models learned and report on the expected accuracy that can beachieved by applying the models. Co:14 Evaluate a given problem and applyappropriate machine learning technique
32.	III	MOE2020	Creative Thinking: Tools& Techniques	Co:14 Comprehend importance in tackling global challenges as well as in everyday problem-solving scenarios Co:15 Apply different brainstorming techniques in group activities Co:16 Be proficient in the application of the 6 thinking hats tool in different life scenarios Co:17 Develop a systematic approach to idea generation through the use of morphological analysis Co:18 Innovate on an existing product, service or situation applying the SCAMPER method Co:19 Get confident with the theory of inventive problem solving, called TRIZ Co:20 Select and apply the appropriatetechnique based on the opportunity to seize or the problem to tackle
33.	III	MOE2030	MOOC Course	Co:6 Identify the real application and practices of the courses studied, at the industry level. Co:7 Recognize various modeling ,analysis and validation techniques adopted at industries. Co:8 Demonstrate the issue at design,manufacturing and assembly level

34.	III	MOE2040	Condition Monitoring and Signal Processing	Co:10 Identify the maintenance scheme, their scope and limitations – apply the maintenance strategies to various problems in the industrial sectors. Co:11 Analyze for machinery condition monitoring and explain how this compliments monitoring the condition Co:12 Develop an appreciation for the need of modern technological approach for plant maintenance to reduce the maintenanceexpenditure. Co:13 Emphasizes on case studies that require gathering information using the moderntesting equipment and processing it to identify the malfunction in that system. Co:14 Identify vibration measurement,lubrication oil analysis.
35.	III	MOE2050	Aircraft Conceptual Design	Co:12 Understand the design process of aircraft and decide the aircraft configuration. Co:13 Choose type of power plant as per flight regime. Co:14 Decide the fuselage layout as per type of aircraft. Co:15 Design the wing for type of aircraft andits wing loading. Co:16 Accurately evaluate lift, drag and massfor design synthesis process. Co:17 Examine the influence of various design requirements on the configuration of an aircraft to derive an optimized design.
36.	III	MTE3021	Dissertation Phase I	Co:1 Explain the contributions of various researchers in the field of thermal engineering after carrying out literature survey from reputed journals Co:2 Recognize the gap in the research and define a problem statement Co:3 Explain significance and applicability of problem statement Co:4 Summarize and present technical data in report format
37.	III	MTE3031	Dissertation Phase II	Co:1 Outline the work plan for problem statement Co:2 Identify the proper modeling and analysistool Co:3 Reproduce the preliminary results ofproblem statement Co:4 Summarize and present technical data inreport format
38.	IV	MTE4011	Dissertation Phase III	Co:1 Explain the issues related to methodadopted in solving the problem Co:2 Select proper technique in solving theproblem Co:3 Compare the results with available literature.
39.	IV	MTE4021	DissertationPhase- IV	Co:1 Design new methodology to address the problem Co:2 Justify the results obtained from new methodology Co:3 Write technical report and defend work.

Mechatronics Engineering

- **Department Name :- Mechatronics Engineering**
- **UG Program Name: - B.Tech. Mechatronics Engineering**
- **Vision and Mission :-**

Vision: To transform the department into center of excellence by synergizing teaching, learning and research to produce globally competent Mechanical Engineers who are innovative, entrepreneurial, and successful in advanced fields of engineering and research.

Mission:

- To impart better quality education to the students for grooming them into globally competent mechanical engineers by building their capacity and strengthening skills.
- To collaborate with research organizations, reputed educational institutions, industries and alumni for excellence in teaching, research and consultancy practices.
- To develop state of the art facilities to stimulate faculty, staff and students to create, analyze, apply and disseminate knowledge.

Sr. No.	Program Outcomes
25.	Apply the knowledge of mathematics, science, engineering fundamentals, and mechanical engineering to the solution of complex engineering problems.
26.	Identify, formulate, review research literature, and analyze complex mechanical engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
27.	Design solutions for complex mechanical 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.
28.	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.
29.	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex mechanical engineering activities with an understanding of the limitations.
30.	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.
31.	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
32.	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
33.	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
34.	Communicate effectively on complex mechanical 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.

35.	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.
36.	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.

Sr. No.	Program Specific Outcomes
5.	Apply the knowledge of basic sciences, analytical skills and modern computing tools to design, perform and analyse experiments to meet desired goals using knowledge of Mechatronics Engineering.
6.	Use the principles of solid mechanics, fluid mechanics, strength of materials,advanced functional materials and manufacturing processes to design, manufacture,and commissioning of mechatronics systems.
7.	Apply concepts of circuit analysis, analog and digital electronics, controls, electricdrives, instrumentation, power systems, programming languages to design and develop automation of mechatronics systems.

2021-22

Semester	Course Name	Course Code	Course Outcome
Semester-III	**Embedded Systems**	**MC201**	**1.** Explain the fundamentals of Embedded Systems. **2.** Identify embedded peripheral for applications **3.** Select the appropriate microcontroller for given application **4.** Differentiate the embedded systems on the basis of its characteristics
	Fundamentals of Mechatronics	**MC203**	**1.** Identify various elements of mechatronics systems. **2.** Select appropriate sensor/Actuator/controller/control algorithm for different applications **3.** Develop PLC/ microcontroller based applications.
	Engineering Mechanics	**MC205**	**1.** Calculate the resultant for concurrent and non-concurrent force systems. **2.** Draw the free body diagram and apply the equations of equilibrium to 2D and 3D rigid bodies **3.** Compute the moment of inertia of standard composite section. **4.** Explain particle dynamics and compute various forms of stored energy under gradually and suddenly applied load conditions **5.** Applythe D'Alembert's, Work Energy and collision principle to analysis in plane motion bodies.
	Fluid Mechanics and Fluid Machines	**MC207**	**1.** Define, calculate, measure properties of fluid **2.** Apply Continuity equation, Bernoulli's equation, Equation of motion and Momentum equation for different flow system. **3.** Estimate forces acting on fluid & different energy losses in fluid flow. **4.** Estimate forces acting on bodies submerged in fluid. **5.** Apply basic concept of fluid mechanics for dimensional analysis **6.** Select proper hydraulic machine for proper application & perform hydraulic design.

	Manufacturing Processes and Machine Tools	**MC209**	**1.** Select suitable Engineering forming process for production of component of required specification **2.** Select casting as manufacturing process suitable for the component design and production volume **3.** Select suitable furnaces in casting process as per requirement. **4.** Select appropriate joining process for given application. **5.** Illustrate and identify main parts of machine tools for metal cutting operations. **6.** Explain working principle of grinding & non-conventional machining processes.
	Electrical Machines	**MC211**	**1.** Explain basic principles and concepts regarding electrical machines. **2.** Describe construction, working and types of Transformers and DC machines. **3.** Explain construction, working and control for Induction and synchronous machines. **4.** Analyze performance characteristics of AC and DC machines. **5.** Identify industrial applications for special motors
	Environmental Science	**SH2173**	1. Discuss the importance and sensitivity of environment**.** 2. Interpret the over exploitation of natural resources and follow the environmental ethics. 3. Explain methods to protect environment and prevent environmental pollution. 4. Apply their knowledge and skills to solve environment related problems
	Engineering Mechanics Lab	**MC251**	**1.** Explain the various laws studied in engineering mechanics. **2.** Calculate the forces and deflection in structural member. **3.** Develop the physical sense towards the engineering mechanics term and establish relation between them.
	Fluid Mechanics and Fluid Machines lab-I	**MC253**	**1.** Verify and apply Bernoulli's Theorem. **2.** Determine coefficient ofdischarge offluid flow apparatus. **3.** Calculate various losses through pipes. **4.** Draw performance characteristic curves for pumps, compressors and turbines **5.** Evaluate various efficiencies of pumps, compressors and turbines.
	Fundamentals of Mechatronics Lab	**MC255**	**1.** Develop PLC ladder logic for given engineering problem. **2.** Integrate electrical, electronic and mechanical components. **3.** Justify the use of PLC and Microcontroller in mechatronic system design
	Workshop Practice –I (Electrical Machine Lab)	**MC257**	6. Perform experiments on AC and DC machines 7. Demonstrate testing and control of various electrical machines. 8. Plot the characteristics of various electrical machines. 9. Analyze the performance parameters of electrical machines. 10. Compare the performances of the electrical machines
	Technical Aptitude -I	**MC259**	**1.** Apply the knowledge acquired during the course work. **2.** Develop the ability of problem solving.
	Environmental Science Project	**SH2603**	**1.** Utilize scientific methods to solve environmental problems. **2.** Evaluate technologies for restoration of degraded environment. **3.** Develop presentation and report writing skills. **4.** Develop as an individual and in group leadership quality

	Professional Leadership Skills	**SH2633**	**1.** Explain the traits of a leadership through real life examples. **2.** Exhibit the ability to work effectively in team. **3.** Prepare a presentation as per the audience and context requirements.
	Interpersonal Skills ('Jeevanvidya' for Work Life Balance)	**SH2613**	**1.** Exhibit interpersonal communication skills. **2.** Demonstrate decision-making skills. **3.** Apply conflict resolution styles appropriate in different situations. **4.** Demonstrate skills to manage balance in work and life. **5.** Apply Jeevanvidya wisdom in day to day life.
	Innovation Tools and Methods for Entrepreneurs	**SH2693**	1. Explain structured approach to define the problem with every possible detail, identify conflicts and solve them 2. Apply User Journey Map to the selected problem to show user interaction at various stages 3. Analyze the solutions provided by competitors for effectiveness and gaps if any.
	Personal Effectiveness and Body Language	**SH2593**	**1.** Develop skills to build self-esteem and positive attitude. **2.** Develop interpersonal skills characterized by effective communication and conflict resolution. **3.** Discover ways to overcome procrastination. **4.** Demonstrate responsiveness towards stress and health issues. **5.** Interpret the non-verbal behaviour of a person.
	German Language-Basic Level	**SH 2733**	4. Interpret the language if the next person is speaking slowly and clearly. 5. Make use of the language in routine life with the routing topics like family, shopping, work etc. 6. Demonstrate the language by self-introduction in German with simple sentences.
	Japanese Language - Level III	**SH2713**	**1.** Make use of basic conversations in various situations. **2.** Identify the sentence patterns. **3.** Explain insights about the communication required for living in Japan. **4.** Interpret Japanese work ethics required in their professional career.

Semester	**Course Name**	**Course Code**	**Course Outcome**
Semester-IV	**Engineering Mathematics - III**	**SH2083**	**1.** Illustrate curve fitting concepts in Mechatronics related problems. **2.** Compute problems on probability distribution by using different formulae. **3.** Evaluate differential equation using appropriate concept. **4.** Analyze the problem and apply the concept of partial differential equations. **5.** Evaluate Laplace & inverse Laplace transform of function and solve ordinary differential equations and linear time invariant systems. **6.** Develop Fourier series of periodic functions.
	Strength of Materials	**MC202**	**1.** Determine different types of stresses and strains induced in any machine component. **2.** Develop shear force and bending moment diagram for different types of beam. **3.** Determine stress distribution for various cross sections of beam. **4.** Estimate the deflection of beams by analytical and graphical method **5.** Analyze axially loaded column for different end conditions.
	Microcontrollers	**MC204**	**1.** Explain the fundamentals of Embedded Systems. **2.** Write programs in Embedded C **3.** Interface peripherals with PIC microcontroller

			4. Design the system using a PIC microcontroller.
	Kinematics & Dynamics of Machines	**MC208**	**1.** Select suitable mechanisms for given application **2.** Analyze the mechanism for velocity and acceleration **3.** Design the CAM for given condition **4.** Apply appropriate power transmission method for mechanical system **5.** apply different techniques to balance the rotary and reciprocating systems **6.** Evaluate and analyze the parameters affecting on stability of spinning bodies due to gyroscopic effect
	Computer Programming C++	**MC210**	**1.** Build Object Oriented Programs. **2.** Elaborate the concepts of "inline function", "friend function", "function overloading" and "operator overloading". **3.** Extend the program by using inheritance. **4.** Use memory management technique "constructors" & "destructors". **5.** Handle different file handling techniques like "Create', "Open", "Close" files and perform "Read", "Write" and "Append" operations. **6.** Write C^{++}program to draw simple geometric shapes.
	Microcontroller lab	**MC250**	**1.** Write embedded C programs for on chip and off chip peripherals **2.** Interface peripherals with PIC microcontroller. **3.** Compile debug and test logic on PIC microcontroller.
	CAD Modeling Lab	**MC252**	**1.** List the different CAD software used for mechanical engineering. **2.** Create sketches of machine parts. **3.** Model machine parts using CAD software. **4.** Assemble machine Parts by using CAD tool. **5.** Generate detailed drawing views. **6.** Create surface features using surfacing tools.
	Kinematics & Dynamics of Machines Lab	**MC254**	**1.** Select suitable mechanism for given application **2.** Analyse the mechanism by using different methods. **3.** Design the CAM for given condition **4.** Analyse the controlling force and stability of governors. **5.** Apply different techniques to balance the rotary systems **6.** Evaluate and analyze the parameters affecting on stability of spinning bodies due to gyroscopic effect
	Computer Programming C++ Lab	**MC256**	**1.** Build Object Oriented Programs. **2.** Elaborate the concepts of "inline function", "friend function", "function overloading" and "operator overloading". **3.** Extend the program by using inheritance. **4.** Use memory management technique "constructors" & "destructors". **5.** Handle different file operations like "Create', "Open", "Close" files and perform "Read", "Write" and "Append" operations. **6.** Write programme to draw simple geometric shapes.
	Workshop Practice - II	**MC258**	**1.** Demonstrate effect of variables such as speed, feed and depth of cut on machining process **2.** Produce given joint by MIG welding process. **3.** Produce welding run on S.S. by TIG welding. **4.** Produce given job with proper taper and V threading within dimensional tolerances ± 0.2 m.m. on diameter and ± 0.5 m.m. on length. (Job – A)
	Technical Aptitude - II	**MC260**	**1.** Apply the knowledge acquired during the course work. **2.** Develop the ability of problem solving.
	Professional Leadership Skills	**SH2633**	**1.** Explain the traits of a leadership through real life examples. **2.** Exhibit the ability to work effectively in team.

			3. Prepare a presentation as per the audience and context requirements.
	Interpersonal Skills ('Jeevanvidya' for Work Life Balance)	**SH2613**	**1.** Exhibit interpersonal communication skills. **2.** Demonstrate decision-making skills. **3.** Apply conflict resolution styles appropriate in different situations. **4.** Demonstrate skills to manage balance in work and life. **5.** Apply Jeevanvidya wisdom in day to day life.
	Innovation Tools and Methods for Entrepreneurs	**SH2693**	**1.** Explain structured approach to define the problem with every possible detail, identify conflicts and solve them **2.** Apply User Journey Map to the selected problem to show user interaction at various stages **3.** Analyze the solutions provided by competitors for effectiveness and gaps if any.
	Personal Effectiveness and Body Language	**SH2593**	**1.** Develop skills to build self-esteem and positive attitude. **2.** Develop interpersonal skills characterized by effective communication and conflict resolution. **3.** Discover ways to overcome procrastination. **4.** Demonstrate responsiveness towards stress and health issues. **5.** Interpret the non-verbal behaviour of a person.
	German Language-Advanced Level	**SH 2643**	**4.** Interpret the language if the next person is speaking slowly and clearly. **5.** Make use of the language in routine life with the routing topics like family, shopping, work etc. **6.** Demonstrate the language by self-introduction in German with simple sentences.
	Japanese Language - Level IV	**SH2623**	**1.** To be able to make basic conversations in various situations. **2.** To recognize the sentence patterns. **3.** To improve Japanese Language proficiency. **4.** To give students insights about the communication required for living in Japan. **5.** To expose students to the Japanese work ethics required in their professional careers.

Science and Humanities

- **Department Name: - Science and Humanities**
- **UG Program Name :-_F.Y.B.Tech.**

Sr. No.	Semester	Course Code	Course Name	COs	Course Outcome
1.	**I/II**	**SH 1034**	**Engineering Chemistry**	CO1	Relate to the basic concepts of chemistry in engineering
				CO2	Select the correct instrumental techniques for the examination of materials.
				CO3	Examine water quality for industrial and domestic sector and suggest remedial measures
				CO4	Illustrate construction, working and applications of batteries and fuel cells
				CO5	Identify causes of corrosion and its remedial measures
				CO6	Compare types and quality of fuels and lubricants
2.	**I**	**SH 1054**	**Engineering Mathematics I**	CO1	Sketch the curve with full justification.
				CO2	Apply the properties of special functions to evaluate integral.
				CO3	Evaluate double integral and change the order of the integration.
				CO4	Evaluate area bounded between two curves, mass of Lamina, moment of inertia.
				CO5	Prove the results of partial differentiation.
				CO6	Apply partial differentiation for evaluating and proving the results based on Errors approximations ,minima and maxima
3.	**I/II**	**SH1292**	**Electrical Engineering**	CO1	Solve magnetic circuits, d.c. and a.c. electric circuits.
				CO2	Describe construction, working and application of transformers.
				CO3	Describe construction, working and application of different types of commonly used rotating machines.
				CO4	Classify power converters on the basis of their applications.
				CO5	Suggest suitable capacity of wires, cables switchgear and illumination system for low voltage electrical installations.
4.	**I/II**	**SH1331**	**Programming for Problem Solving**	CO1	Explain the basic terminology and concepts of C programming language.
				CO2	Design Algorithm and Flow Chart for the given problem.
				CO3	Write, Compile and execute 'C' programs for a given problem.
				CO4	Analyze the given C Program to predict the output
				CO5	Evaluate the C program to resolve the errors
5.	**I/II**	**SH1533**	**Engineering Chemistry Lab**	CO1	Examine the materials by using analytical instruments.
				CO2	Identify the quality of water for industrial and domestic purposes.
				CO3	Apply the knowledge of electrochemistry for design of various cells and batteries.

				CO4	Select proper Lubricant for different machines according to working condition.
				CO5	Inspect the quality of fuel.
6.	**I/II**	**SH1911**	**Programming for Problem Solving Lab**	CO1	Describe orally the basic terminology and concepts of C programming language.
				CO2	Develop algorithm and flow chart for the given problem.
				CO3	Write, compile and execute 'c' programs for a given problem.
				CO4	Evaluate the C program to resolve the errors.
				CO5	Debug the program to predict the correct output.
7.	**I**	**SH1832**	**English Proficiency Lab. I**	CO1	Demonstrate reception skills of language
				CO2	Communicate using oral and written mode.
				CO3	Make use of English language with grammatical accuracy.
				CO4	Articulate correctly the frequently used words using phonemic transcriptions
8.	**I**	**SH1851**	**Engineering Practice Lab. I**	CO1	Acquire skills in basic engineering practice.
				CO2	Use of hand tools and power tools.
				CO3	Develop sheet metal model for specific application.
				CO4	Understand the various operations performed in machine shop.
				CO5	Perform different joining operations
				CO6	Perform pipe fittings operations.
9.	**I/II**	**SH1311**	**Engineering Physics**	CO1	Compare the behaviour of mechanical system under damping and external periodic force
				CO2	Use principle of interference in thin reflecting films with uniform and non-uniform thickness
				CO3	Solve problems of 1-d potential box using principles of quantum physics
				CO4	Illustrate the types of semiconductor, hall effect, basics of laser production with application and fiber optics communication
10.	**II**	**SH1024**	**Engineering Mathematics II**	CO1	Use the concepts of matrices that serve as an essential basis for several computational techniques.
				CO2	Solve the differential equations by choosing proper method of solution.
				CO3	Solve the problems on orthogonal trajectories, simple electrical circuits, andheat flow by applying the methods of ordinary differential equations.
				CO4	Use the relevant method for solving simultaneous algebraic linear equations.
				CO5	Apply the relevant numerical method for interpolating the polynomial.
				CO6	Apply appropriate numerical method to compute the solution of ordinary differential equations.
11.	**I/II**	**SH1133**	**Engineering Graphics**	CO1	Determine the location of the location and orientation of point, line, and plane with respect to reference planes to draw their projection.
				CO2	Develop the projection of various types of solids in various conditions.
				CO3	Develop section views and true shape section of various types of solids
				CO4	Identify the need of development of lateral surfaces and apply the same in engineering drawing.

				CO5	Develop orthographic views of an object to convert pictorial view into two-dimension (2D) view.
				CO6	Develop isometric view to convert two-dimension (2D) view to pictorial view.
12.	**I/II**	**SE1012**	**Basics of Electronics Engineering**	CO1	Recognize basic semiconductor components and devices used for different electronic applications.
				CO2	Explain working principle of diode, transistor and their applications.
				CO3	Describe the number system, basic structure of computer and processor architecture.
				CO4	Analyze the analog and digital electronic circuits using discrete components.
13.	**I/II**	**SE1052**	**Basics of Civil Engineering**	CO1	Apply fundamental knowledge of civil engineering.
				CO2	Identify building components and materials used in construction along with concepts of suitability and safety of buildings.
				CO3	Use basic principles of planning in the building design and processes involved in the property transactions.
				CO4	Determine horizontal and vertical distances using modern surveying instruments.
				CO5	Illustrate the infrastructural facilities.
14.	**I/II**	**SE1132**	**Green Technology**	CO1	Understand the principles of green chemistry and engineering
				CO2	Design processes that are benign and environmentally viable
				CO3	Design processes and products that are safe and hazard free
				CO4	Learn to modify processes and products to make them green safe and economically acceptable
15.	**I/II**	**SE1451**	**Creativity, Design Thinking and Entrepreneurial Mindset**	CO1	Learn structured approach to creativity, problem identification and problem solving in a new venture context
				CO2	Apply design thinking approach to identify innovation opportunities and develop solutions
				CO3	Identify, validate and define specific innovation opportunities through Jobs-to-be-Done methodology
				CO4	Develop mindset of a successful entrepreneur
16.	**I/II**	**SH1513**	**Engineering Physics Lab**	CO1	Develop the skill of performing the experiments relevant to theories in optics, ultrasound, semiconductors, oscillations and magnetic materials
				CO2	Use different measuring tools and techniques to conduct the experiments
				CO3	Give the physical interpretation for observed measurements and determine the relevant physical quantities
				CO4	Write a lab report which communicates scientific information in a clear manner.
17.	**I/II**	**SH1553**	**Engineering Graphics Lab**	CO1	Determine the location and orientation of point, line, and plane with respect to reference planes to draw their projection.
				CO2	Develop the projection of various types of solids in various conditions.
				CO3	Develop section views and true shape section of various types of solids

				CO4	Identify the need of development of lateral surfaces and apply the same in engineering drawing.
				CO5	Develop orthographic views of an object to convert pictorial view into two-dimension (2D) view.
				CO6	Develop isometric view to convert two-dimension (2D) view to pictorial view.
18.	**I/II**	**SE1512**	**Basics of Electronics Engineering Lab**	CO1	Demonstrate use of various electronic components & equipment's for building applications.
				CO2	Build the circuits using Diode, Transistor Electronics Devices.
				CO3	Construct various applications using Operational Amplifier like Amplifiers.
				CO4	Test the basic logic gates, adders & substractors.
19.	**I/II**	**SE1552**	**Basics of Civil Engineering Lab**	CO1	Draw dimensioned sketch/plan of building
				CO2	Plan building using principles and bye laws.
				CO3	Perform horizontal and vertical measurement.
				CO4	Use modern surveying techniques.
20.	**I/II**	**SE1632**	**Green Technology Lab**	CO1	Illustrate the concept of green technology in energy and building sector.
				CO2	Prepare energy and water budget for a building.
				CO3	Design rainwater harvesting for a small catchment area.
				CO4	Analyze air quality by using HC/CO analyzer.
21.	**I/II**	**SE1671**	**Creativity, Design Thinking and Entrepreneurial Mindset Lab**	CO1	Learn structured approach to creativity, problem identification and problem solving in a new venture context.
				CO2	Apply design thinking approach to identify innovation opportunities and develop solutions.
				CO3	Develop mindset of a successful entrepreneur
22.	**II**	**SH1621**	**English Proficiency Lab. II**	CO1	Demonstrate writing skills through letters, circulars, notices, memos, and emails
				CO2	Apply report writing skills.
				CO3	Organize message in appropriate structures.
				CO4	Prepare job application addressing requirements of the post.
23.	**II**	**SH1641**	**Engineering Practice Lab II**	CO1	Explain & demonstrate facts, concept & techniques of manufacturing of various items in technology area.
				CO2	Develop quality & safety consciousness while working in workshop.
				CO3	Develop respect towards effort, skill &labour work in manufacturing.
				CO4	Demonstrate ability to read drawing & carry out Smithy, Tin smithy, Welding & plumbing operations.
24.	**I/II**	**SH1891**	**Engineering Exploration and Design Project**	CO1	Explain the role of an engineer as a problem solver
				CO2	Design engineering solutions to complex problems utilizing multi-disciplinary systems approach.
				CO3	Examine a given problem using process of engineering problem analysis.
				CO4	Build simple systems/prototypes using engineering design and development process.
				CO5	Analyze engineering solutions from ethical and sustainability perspectives.

				CO6	Apply basics of engineering project management skills in project development.
25.	**I/II**	**SE1072**	**Thermodyna-mics**	CO1	Apply thermodynamics principles to mechanical engineering applications
				CO2	Describe entropy, change in entropy and increase of entropy principle.
				CO3	Differentiate between available and unavailable energy with examples.
				CO4	Apply mathematical fundamental to study the properties of steam, gas and gas mixtures.
26.	**I/II**	**SE1572**	**Thermodyna-mics Lab**	CO1	Conduct test to find properties of oils
				CO2	Explain boilers and mountings
				CO3	Estimate the properties of steam, interpret and comment on the results.
27.	**I/II**	**SE1092**	**Engineering Materials**	CO1	Classify materials on the basis of various properties.
				CO2	Estimate different mechanical properties using destructive testing methods.
				CO3	Select suitable non-destructive testing method for flaw detection in component.
				CO4	Select suitable material for different engineering applications.
				CO5	Identify the recycling issues associated with various engineering materials.
28.	**I/II**	**SE1592**	**Engineering Materials Lab**	CO1	Illustrate stress strain diagram for different materials.
				CO2	Use Rockwell Hardness testing machine to measure hardness of material.
				CO3	Measure impact strength of the metals
				CO4	Determine fatigue strength of metals.
				CO5	Determine flaws in the component using non-destructive testing methods.
				CO6	Explain working principle of emission spectrometer.
29.	**I/II**	**SE147**	**Introduction to Artificial Intelligence**	CO1	Explain the different terminologies used in Artificial Intelligence.
				CO2	Identify engineering and societal problems that can be efficiently solved by artificial intelligence techniques.
				CO3	Demonstrate the search algorithms to solve problems.
				CO4	Apply Python Programming in AI based applications.
				CO5	Illustrate the concepts of machine learning.
				CO6	Describe the robot tasks, architecture and usage in real world.
30.	**I/II**	**SE169**	**Introduction to Artificial Intelligence Lab**	CO1	Identify Real Time Problems with their AI solutions.
				CO2	Demonstrate and explore the functionalities in different programming frameworks & S/W technologies.
				CO3	Solve problems using python programming concepts.
				CO4	Implement supervised learning algorithms using python programming to solve the real time problems.

31.	**I/II**	**SH1792**	**Electrical Engineering Lab**	CO1	After successful completion of the course, students will be able to,
				CO2	Acquaint with the basic concepts and properties of electrical circuits and awareness about
				CO3	safety precautions.
				CO4	Select proper meter/s for measuring electrical quantities during experiments.
				CO5	Explain various electrical circuits (DC, AC) and magnetic circuits through laboratory.
32.	**I**	**SH1583**	**Japanese Language Lab Level I**	CO1	Demonstrate Japanese scripts through oral and written communication.
				CO2	Express themselves by using simple sentences and responses to questions.
				CO3	Demonstrate effective listening.
				CO4	Make use of Japanese etiquette
33.	**I**	**SH1602**	**German Language Lab Level I**	CO1	Make use of everyday expressions and basic phrases aimed at the satisfaction of needs of a concrete type.
				CO2	Express him/herself and others and ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she has.
				CO3	Make use of the basic grammar concepts correctly.
				CO4	Demonstrate reading and writing skills.
34.	**II**	**SE1662**	**Japanese Language Lab Level II**	CO1	Converse in Standard Japanese to perform basic communicative tasks (e.g., exchange greetings/personal information, give time/directions/daily activities)
				CO2	Make use of Japanese vocabulary effectively.
				CO3	Demonstrate reading comprehension
35.	**II**	**SH1681**	**German Language Lab Level II**	CO1	Make use of everyday expressions and basic phrases aimed at the satisfaction of needs of a concrete type.
				CO2	Express him/her and others and ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she has.
				CO3	Make use of basic grammar concepts correctly.
				CO4	Demonstrate reading and writing skills.
36.	**I/II**	**SE1431**	**Basics of Mechanical Engineering**	CO1	Explain different power generation systems.
				CO2	Select appropriate energy conversion device for the given application.
				CO3	Classify vehicles on the basis of different parameters.
				CO4	Compare two stroke and four stroke IC engines.
				CO5	Describe different transmission devices in a given system.
				CO6	Choose suitable materials and manufacturing processes for a given application.
37.	**I/II**	**SE1651**	**Basics of Mechanical Engineering Lab**	CO1	Explain the different components of power generation systems.
				CO2	Identify the systems and components of vehicle.

				CO3	Distinguish between two stroke and four stroke engines.
				CO4	Carry out day to day life maintenance of machines.
				CO5	Explain the different components of power generation systems.

Department of Management Studies (MBA)

- **Department Name :- Department of Management Studies (MBA)**
- **PG Program Name :-Management Studies**
- **Vision and Mission :-**

Vision:-

Achieving excellence in academics and research to develop globally competent and socially responsible managers.

Mission:-

1. To leverage innovation and excellence in academic design, delivery and assessment to ensure holistic development of students for employability, entrepreneurship and higher education.
2. To design and keep the curricula updated, based on changing needs of industry and society worldwide.
3. To build and maintain world-class infrastructure, for sustained learning, development and research.
4. To provide an environment that encourages creativity, analysis and critical thinking.

Sr. No.	Program Outcomes
1.	**PO1:** Apply knowledge of management theories and practices to solve business problems.
2.	**PO2:** Foster Analytical and critical thinking abilities for data-based decision making.
3.	**PO3:** Ability to develop Value-based Leadership ability.
4.	**PO4:** Ability to understand, analyze and communicate global, economic, legal, and ethical aspects of business.
5.	**PO5:** Ability to lead themselves and others in the achievement of organizational goals, contributing effectively to a team environment.
6.	**PO6:** Be capable of self-education and clearly understand the value of lifelong learning.
7.	**PO7:** Be familiar with modern statistical and software tools to analyze business problems.
8.	**PO8:** To examine critically for self-assessment and take corrective measures accordingly without external feedback.

Sr. No.	Semester	Course Code	Course Name	Course Outcome
1.	I	MGC 1012	Principles of Management	Interpret classical & modern theories.
				Apply functions of management in real world scenarios
				Communicate effectively about management decisions.
				Analyze recent trends in live management case studies
				Evaluate the current business landscape and trends.
2.	I	MGC1032	Managerial Economics	Evaluate microeconomic and macroeconomic variables and its implication in business decision making.
				Identify the competitive and global market for making larger presence and leadership.
				Assess and evaluate macroeconomic variables for selection of best alternatives to maximize profit and value of an organization
				Identify issues related to development and governance issue that hinder the development
				Analyse the sectoral development and policies initiated by the governments to improve.
3.	I	MGC1052	Financial Accounting and Analysis	Comprehend the fundamental aspects concerning financial accounting.
				Prepare various accounts and financial statements.
				Analyse and interpret the financial statements by associating the tools and techniques for effective decision-making.
				Apply accounting theory and information as a tool for solving managerial problems
4.	I	MGC1072	Legal & Business Environment	Develop an understanding about micro & macro elements of business environment.
				Analyse the major and minor factors affecting the functioning of business.
				Provide an overview of important laws that have a bearing on the conduct of business in India.

				Analyse the international environment and strategies adopted by firms to expand globally.
				Analyse the dynamics of business environment and its impact on the conduct of business.
5.	I	MGC1092	Marketing Management	Discuss Core concept of marketing and the role of marketing in business and society.
				Develop marketing strategies based on product, price, place and promotion.
				Analyse marketing problems and provide solution based on a critical examination of marketing information.
6.	I	MGC1112	Organizational Behaviour	Analyze the conceptual anchors of Organizational behavior
				Identify personal dimensions of personality. Job satisfaction, motivation and learning
				Demonstrate the group dynamics and its applicability
				Explain organizational change and culture effect on working relationships
				Apply various leadership styles and conflict management strategies used in organizations.
7.	I	MGC1132	Quantitative Analysis	Apply basic mathematical and statistical tools.
				Summarize data visually and numerically.
				Demonstrate analytical skill for solving business problems.
				Interpret results from decision making perspectives
8.	I	MGC1152	Indian Ethos and Business Ethics	Interpret the variable values in morality
				Propose strategies for maximizing personal growth and productivity of employees.
				Apply value-based management and ethical practices in all functional areas of management
				Develop ethical decision-making capabilities
				Comprehend and practice the way of righteousness in the Indian mythological literature
9.	I	MGC1172	Business Communication	Write business letters in a proper, formal format
				Demonstrate the methods of oral presentation both in a formal and informal environment
				Review the importance of communication relative to securing employment, with emphasis on using both verbal and non-verbal communication and their impact
				Prepare the student with the communication tools-verbal, non-verbal and written-and the practical applications inherent in each
10.	I	MGC1192	Advanced Excel	Customize the formatting of spreadsheet in Excel.
				Protect data in worksheets & workbooks
				Design the structure of various template.
				Consolidate & analyze data from multiple sheets & create reports
11.	I	MGC 1212	MS Power Point	Demonstrate applying themes and layouts to slides.
				Demonstrate inserting pictures, graphics, shapes, and other things.
				Demonstrate working with sound and videos, master slides, smart art.
				Use existing PowerPoint presentations using advanced editing tools such as theme, layout, timing, and animation
12.	II	MGC1022	Corporate Finance	Discuss important aspects of financial management that can help an entity to operate more effectively.
				Apply financial theory while identifying the sources of finance and calculate the cost of capital for effective decision-making.
				Apply capital structure theories and leverage analysis to frame optimal capital structure.
				Evaluate investment proposals by applying capital budgeting techniques.

				Estimate the working capital requirement for solving managerial problems
13.	II	MGC1042	Operations Management	Demonstrate fundamentals of operations management in a firm.
				Take decisions related to facility locations & layout.
				Analyze different aspects relating to designing & developing processes.
				Apply various aspects in Operations Planning and Control.
				Evaluate various modern practices in operations management
14.	II	MGC1062	Human Resource Management	Effectively manage and plan key human resource functions within organizations
				Identify and analyze problems in the field of HRM and provide innovative solutions
				Appreciate the implications of increasing globalization for the management of human resources
				Evaluate and implement the new trends in HRM
15.	II	MGC1082	Business Research Methods	Apply the major types of research designs
				Formulate clearly defined research questions
				Analyze and summaries key issues and themes from existing literature
				Evaluate and conduct research
				Understand the ethical issues associated with the conduct of research
16.	II	MGC1102	Managing for Sustainability	Demonstrate a multi –stakeholder perspective in viewing CSR issues.
				Analyse the impact of CSR implementation on corporate culture.
				Evaluate the concept of corporate governance.
				Analyse the main factors and structures of corporate governance and show how their interaction and functioning differs across national economies.
				Discuss open issues concerning the future evolution of corporate governance in the context of globalization
17.	II	MGC1122	Management Information System	Explain the role and significance of management information systems in business.
				Apply the decision support tools of information system to solve business problems.
				Identify the causes of information system success and failure.
				Implement the information system in various functional areas of management.
				Demonstrate the better usage of e-business, e-governance, AI etc
18.	II	MGC1142	Strategic Management	Comprehend the basic concepts and principles of strategic management
				Analyze the competitive situation and strategic dilemma in dealing with dynamic business environment
				Demonstrate the knowledge and abilities in formulating strategies and strategic plans
				Evaluate challenges faced by managers in implementing and evaluating strategies based on the nature of business, industry, and cultural differences
19.	II	MGC1162	International Business	Describe the foundation of international business.
				Discuss the business operations of international organizations and multinational corporations.
				Analyze forms of foreign involvement.
				Discuss and apply international trade theory
20.	II	MGC1182	Soft core (General Aptitude Skills)	Evaluate critically key issues concerns with real life situation.

				Apply innovative thinking skill to solve the problems.
				Demonstrate various principle involved in solving mathematical problems.
				Evaluate assumptions used in analyzing quantitative data
21.	II	MGC1202	Data Analysis using SPSS	Develop proficiency in handling SPSS software.
				Analyse data sets using various descriptive and inferential statistical tools
22.	II	MGC1222	Capstone Project Phase I	Identify a Social / Business problem.
				Prepare a Synopsis for developing or solution for the identified problem.
				Design the survey tool
23.	III	MGC2012	Entrepreneurship Development	Identify the values, attitudes and motivation for a plunge in entrepreneurship.
				Impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.
				Develop and strengthen their entrepreneurial quality and motivation to start their own small-scale business/enterprise.
				Analyze the entrepreneurial ecosystem and design strategies accordingly
24.	III	MGE205	Mall Management	Analyze the concepts and aspects needed for mall management.
				Apply the operational and tenant management principles for malls.
				Evaluate the marketing and promotional principals for the malls.
				Illustrate the statutory requirements for the mall operations
25.	III	MGE215	Export – Import Procedure & Documentation	Provide an overall perspective on import & export management.
				Develop an understanding towards export and import procedure and documentation.
				Develop analytical skills for processing of export order.
				Identify & managing risk involves in the import & export transactions
26.	III	MGE216	Supply Chain Management	Understand the fundamental concepts and importance of Supply Chain Management.
				Apply methods for managing demand & supply position in supply chain network.
				Manage inventory in Supply chain network.
				Plan and design transportation networks relating to supply chain management.
				Demonstrate the role & importance of logistics management
27.	III	MGM2012	Sales and Distribution Management	Develop the knowledge of Selling and Distribution process in an organization.
				Develop proficiency in industry in actual selling process and the management of selling personnel.
				Demonstrate the knowledge needed to generate a leads and increase the sales in terms of volume and in monitory terms.
				Analyze critical and strategic thinking, improve analytic skills and techniques, and enhance effective decision-making in sales and Distribution.
				Identify the management challenges to construct & design Distribution Channel to find appropriate way to reach to the customers
28.	III	MGM2032	Services Marketing	Identify the special management issues and unique challenges involved in marketing and managing services
				Understand the expectations of customers and know how to translate this knowledge into genuine value for customers
				Interpret service behavior and service consumption in the light of service-dominant marketing logic and articulate the outcome to service marketing management

				Appreciate, modify, and/or extend new theories and concepts pertaining to explaining the characteristics of customers' purchasing and consumption behavior of services and service firms' marketing behavior
				Apply new approaches to managing customer satisfaction and loyalty nt
				Understand current research trends in services marketing and management
29.	III	MGM2072	Consumer Behavior	Assess the relevance of consumer behavior to the entire marketing process.
				Analyze the causes giving rise to consumer behavior with the theories.
				Explain the impact of consumer behavior on the development of marketing strategies including marketing communication, segmentation and target marketing.
				Apply the concepts and theories covered in the course to devise effective solutions in enhancing business performance..
				Collaborate with other classmates productively on the group work, communicate and present information effectively
30.	III	MGH2012	Compensation Management	Apply the knowledge to solve compensation related problems in organizations
				Design rational and contemporary compensation systems in modern organizations
				Design and maintain a pay system within the organization
				Analyze and develop incentive programs
				Explain the legally required employee benefits
31.	III	MGH2072	Industrial Relations and Labour Laws	Acquire a theoretical, practical and ethical perspective on many aspects of industrial relations.
				Apply IR competencies to contribute to organizational capability & employee well being.
				Explain the various forms and causes of Industrial disputes.
				Assess the collective bargaining process, including preparation, negotiation, and settlement.
				Understand the statutory provisions concerning the grievance procedure in India
32.	III	MGH2092	Human Resource Planning	Analyze the theory and concepts of human resource planning.
				Identify the evolution of HRP throughout the organization.
				Apply models and methods used in forecasting.
				Describe the applications of a succession analysis & planning.
				Evaluate the organization's planning program
33.	III	MGF2012	Indian Financial System	Elaborate the key role played in a modern society by financial markets & its intermediaries.
				Elaborate the key role played in a modern society by financial markets & its Intermediaries
				Apply the knowledge of the relative standing of the major financial services in India for various business organizations
				Evaluate the functioning of banking & NBFC in current scenario and discuss the various important aspects concern with banking and non-banking organizations.
				Demonstrate the concept of mutual fund also focus on other relative aspects of mutual fund industry
34.	III	MGF2052	International Finance	Explain the fundamental of international business, finance as well as international financial markets
				Describe the various important aspects concern with foreign exchange markets and apply the knowledge of exchange rate mechanism

				Explain the risks in international operations & apply the techniques to cover it. Also understand the various exchange control regulations.
				Describe long term asset and liability management. Also evaluate project and provide suggestions to the organization.
				Demonstrate short term asset and liability management in international business
35.	III	MGF2092	Funds Management in Banking and Insurance	Get an insight into the liquidity management in commercial Banking business and discuss the necessity of adequate capital fund.
				Explain different types of reserves & different factors affecting on its requirement.
				Understand the different aspects related with Management of Bank loan.
				Evaluate the performance of Bank on the basis of deposit mobilization, credit deployment & profitability.
				Discuss different functions & principles of life & non-life insurance. Also describe role of insurance & risk management policies related with non-life insurance
36.	III	MGB2012	Marketing Analytics	Apply marketing theories to given research problems and types of customer data.
				To critically evaluate business problems and determine the most appropriate analytical technique
				Design an appropriate course of action based on empirical evidence.by gaining insights from the analysis of data
				Formulate and confidently communicate (oral and written) research findings that is understandable to marketing managers
37.	III	MGB2052	Core Python Programming	Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
				Express different Decision-Making statements and Functions
				Interpret Object oriented programming in Python
				Summarize different File handling operations
				Create and execute Python programs
38.	IV	IP204	Project Management (Online Course)	Prepare business Plan for selected business.
				Make risk analysis& market analysis of selected project.
				Make risk analysis& market analysis of selected project
				Make financial appraisal of selected project
39.	IV	IP206	Internship & Project	Examine the functioning of the company on the terms of inputs, transformation process and the outputs (products and services)
				Develop an attitude to adjust with the company culture, work norms, code of conduct.
				Recognize and follow the safety norms, Code of conduct.
				Demonstrate the ability to observe, analyse and document the details as per the industry practices.
				Interpret the processes, systems and procedures and to relate to the theoretical concepts- studies.
				Develop the leadership abilities, communication.
				Demonstrate project management and finance sense
40.	IV	ED3002	Project Management	Prepare business Plan for selected business.
				Make risk analysis & market analysis of selected project.
				Make risk analysis & market analysis of selected project
				Make financial appraisal of selected project
41.	IV	ED3004	New Venture Finance Startup Funding For Entrepreneurs)	Apply the strategic aspects of entrepreneurial finance.
				Identify various sources of finance from sources like venture capital, angel financer, private equity and hedge funds and their working procedures,

				Conduct valuation of companies by venture capitalist
				Compare different sources of finance and select the appropriate source for financing needs.
42.	IV	ED3006	Entrepreneurship Development Program (EDP)	Apply knowledge of management, economics, marketing and finance for formulation of business plan, starting & managing new business
43.	IV	ED3008	Entrepreneurship Development Project	Apply knowledge of Management for preparation of project report.
				Make commercial, technical and financial appraisal of project