# PROGRAMME OUTCOME, PROGRAMMESPECIFIC OUTCOMES AND COURSEOUTCOMES OF ALL DEPARTMENTS–2023-24(CRITERIA- 2)

## Department of Civil Engineering

**Program Outcomes (PO's)**

**PO 1:** To apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems

**PO 2:** To identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

**PO 3:** To 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.

**PO 4:** To use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

**PO 5:** To create, select and apply appropriate techniques, resources, and modern engineering and IT tools including predictions and modeling to complex engineering activities with an understanding of limitations.

**PO 6:** To apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

**PO 7:** To understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

**PO 8:** To apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

**PO 9:** To function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO 10:** To communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO 11:** To 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.

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

### Program Specific Outcomes (PSO's)

**PSO1:** Capable to study, plan, analyse and design the civil engineering structures required for the professional demands.

**PSO2:** Utilize the appropriate software and related modern tools to develop skills to plan, produce detailed drawings, write specifications, and prepare cost estimates of civil engineering structures.

**PSO3:** Offer engineering services with professional, environmental and ethical responsibility.

# COURSE OUTCOMES

| Coarse Code | STRENGTH OF MATERIALS – BCV301 |
|---|---|
| CO1 | Evaluate the simple stresses, strains and compound stresses |
| CO2 | Calculate the Bending moments, shear force and draw BMD, SFD for various types of beams and loadings |
| CO3 | Calculate the Bending moments, shear force and draw BMD, SFD for various types of beams and loadings |
| CO4 | Calculate the Bending moments, shear force and draw BMD, SFD for various types of beams and loadings |
| CO5 | Evaluate the behaviour and strength of structural elements under the action of compound stresses and stresses in thin and thick cylinders. |

| Coarse Code | ENGINEERING SURVEY- BCV302 |
|---|---|
| CO1 | Summarize various types of surveying and carry out distance measurement using various equipment's |
| CO2 | Illustrate the use and applications of levelling and theodolite |
| CO3 | Plot contours, longitudinal and cross sections for construction projects. |
| CO4 | Set curves for construction works and carry out estimation of areas and volumes. |
| CO5 | Demonstrate the necessary skills to carry out GPS and DRONE Surveying |

| Coarse Code | ENGINEERING GEOLOGY– BCV303 |
|---|---|
| CO1 | Apply geological knowledge in different civil engineering practice. |
| CO2 | Acquire knowledge on durability and competence of foundation rocks, and will be able to use the best building materials. |
| CO3 | Students will become competent enough for the safety, stability, economy and life of the structures that they construct |
| CO4 | Able to solve various issues related to ground water exploration, build up dams, bridges, tunnels which are often confronted with ground water problems |
| CO5 | Students will become Intelligent enough to apply GIS, GPS and remote sensing as a latest tool in different civil engineering for safe and solid construction. |

| Coarse Code | WATER SUPPLY AND WASTEWATER ENGINEERING– BCV304 |
|---|---|
| CO1 | Estimate the average and peak water demand for a community |
| CO2 | Evaluate water quality and environmental significance of various parameters and plan suitable treatment system. |
| CO3 | Design the different units of water treatment plant |
| CO4 | Design the various units of wastewater treatment plant. |
| CO5 | Design of various AOPs and low cost treatment units. |

| Coarse Code | COMPUTER-AIDED BUILDING PLANNING AND DRAWING – BCV305 |
|---|---|
| CO1 | Prepare, read and interpret the drawings in a professional set up. |
| CO2 | Know the procedures of submission of drawings and Develop working and submission drawings for building. |
| CO3 | Plan and design of residential or public building as per the given requirements. |

| Coarse Code | SOCIAL CONNECT AND RESPONSIBILITY– BCV307 |
|---|---|

| CO1 | The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem. |
|---|---|
| **Coarse Code** | **FIRE SAFETY IN BUILDINGS – BCV306D** |
| CO1 | Understand types of fire, combustion process and fire resistance |
| CO2 | Plan for fire safety and design of lifts |
| CO3 | Design flow network in buildings |
| CO4 | Design of electrical systems and maintenance |
| CO5 | Perform health evaluation of buildings and suggest remedies |
| **Coarse Code** | **PERSONALITY DEVELOPMENT FOR CIVIL ENGINEERS – BCV358D** |
| CO1 | Use English as a medium of communication in interviews and in any professional working environment proficiently |
| CO2 | Develop necessary skills to Answer common interview questions, express confidence in body language and present with clarity |
| **Coarse Code** | **ANALYSIS OF STRUCTURES- BCV401** |
| CO1 | identify the different forms of structural systems and analyse the trusses |
| CO2 | Evaluate the slope and deflections in beams, frames and trusses by using moment area method and energy principle |
| CO3 | Analyse and determine the stress resultants inarches and cables |
| CO3 | Analyse the indeterminate structures and construct BMD AND SFD using slope deflection methods. |
| CO3 | Analyse the indeterminate structures and construct BMD AND SFD using Moment Distribution Method. |
| **Coarse Code** | **FLUID MECHANICS AND HYDRAULICS – BCV402** |
| CO1 | Explain the fundamental properties of fluids and solve problems on fluid pressure and hydrostatics. |
| CO2 | Apply the principles of kinematics and dynamics of fluid flow to solve problems on velocity and pressure. |
| CO3 | Compute the discharge through pipes, notches and weirs. |
| CO4 | Design the turbines and open channels of different sections and to estimate the energy loss in hydraulic jump. |
| CO5 | Able to interpret the experimental results of discharge, efficiency based on the test conducted in the laboratory. |
| **Coarse Code** | **TRANSPORTATION ENGINEERING– BCV403** |
| CO1 | Explain the basic principles of geometric design in the context of transportation engineering and planning |
| CO2 | Select the appropriate pavement materials for construction and design the pavement as per standard practices. |
| CO3 | Conduct traffic studies and analyse traffic data for practical applications. |

| CO4 | . Identify the Components parts of Railway Track and design the suitable runway for an Airport |
|---|---|
| CO5 | Able to interpret the experimental results of highway materials based on laboratory tests and design the pavement as per IRC guidelines. |
| **Coarse Code** | **EARTH RESOURCES AND ENGINEERING LABORATORY – 21BE45** |
| CO1 | Elucidate the basic biological concepts via relevant industrial applications and case studies |
| CO2 | Evaluate the principles of design and development, for exploring novel bioengineering projects. |
| CO3 | Corroborate the concepts of biomimetics for specific requirements. |
| CO4 | Think critically towards exploring innovative biobased solutions for socially relevant problems |
| **Coarse Code** | **BUILDING MATERIALS LABORATORY- BCV404** |
| CO1 | Analyze the physical characteristics, and behavior of common building materials. |
| CO2 | Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion for steel |
| CO3 | Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials. |
| CO4 | Recognize the importance of ethical conduct, integrity, and accuracy in materials testing and reporting.. |
| **Coarse Code** | **BUILDING INFORMATION MODELLING IN CIVIL ENGINEERING – CV405A** |
| CO1 | Interpret the basic principles of BIM evolution and concept of BIM in lifecycle of project |
| CO2 | Understand the workflows of Design authoring followed in industry during creation of 3D model |
| CO3 | Analyze the engineering analysis and the process followed in industry to check and resolve clashes |
| CO4 | Evaluate the integration of schedule and cost in 3D model using 4D and 5D BIM |
| CO5 | Illustrate the various emerging trends of BIM & concept of digital twin |
| **Coarse Code** | **FINANCE FOR PROFESSIONALS- BCV456A** |
| CO1 | Understand how their work and effort contribute to organizational financial performance |
| CO2 | Comprehend financial acumen and tools to optimize outcomes |

| Course Outcomes | OPTIMIZATION TECHNIQUES- 22CSE11 |
|---|---|
| CO1 | Achieve Knowledge of design and development of problem solving skills. |
| CO2 | Understand the principles of optimization. |
| CO3 | Design and develop analytical skills. |
| CO4 | Summarize the Linear, Non-linear and Geometric Programming |
| CO5 | Understands the concept of Dynamic programming |

| Course Outcomes | MATRIX METHODS OF STRUCTURAL ANALYSIS- 22CSE12 |
|---|---|
| CO1 | Formulate force displacement relation by flexibility and stiffness method |
| CO2 | Analyze the plane trusses, continuous beams and portal frames by transformation approach |
| CO3 | Analyse the structures by direct stiffness method |

| Course Outcomes | Advanced design of RC structures - 22CSE13 |
|---|---|
| CO1 | Achieve Knowledge of design and development of problem solving skills. |
| CO2 | Understand the principles of Structural Design |
| CO3 | Design and develop analytical skills. |
| CO4 | Summarize the principles of Structural Design and detailing |
| CO5 | Understands the structural performance. |

| Course Outcomes | MECHANICS OF DEFORMABLE BODIES - 22CSE14 |
|---|---|
| CO1 | Achieve Knowledge of design and development of problem solving skills |
| CO2 | Understand the principles of stress-strain behaviour of continuum |
| CO3 | Design and develop analytical skills |
| CO4 | Describe the continuum in 2 and 3- dimensions |
| CO5 | Understand the concepts of elasticity and plasticity. |

| Course Outcomes | STRUCTURAL DYNAMICS – 22CSE15 |
|---|---|
| CO1 | Achieve Knowledge of design and development of problem solving skills. |
| CO2 | Understand the principles of Structural Dynamics |
| CO3 | Design and develop analytical skills. |
| CO4 | Summarize the Solution techniques for dynamics of Multi-degree freedom systems |
| CO5 | Understand the concepts of damping in structures. |

| Course Outcomes | Structural engineering lab 1 -22CSEL16 |
|---|---|
| CO1 | Achieve Knowledge of design and development of experimenting skills. |
| CO2 | Understand the principles of design of experiments |
| CO3 | Design and develop analytical skills. |
| CO4 | Summarize the testing methods and equipments. |

| Course Outcomes | RESEARCH METHODOLOGY AND IPR -22RMI17 |
|---|---|
| CO1 | Discuss research methodology and the technique of defining a research problem |
| CO2 | Explain the functions of the literature review in research, carrying out a literature search, developing |
| CO3 | Explain various research designs and their characteristics. |
| CO4 | Explain the art of interpretation and the art of writing research reports |

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| CO5 | Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR |
| **Course Outcomes** | **ADVANCED DESIGN OF STEEL STRUCTURES - 22CSE21** |
| CO1 | Able to understand behavior of Light gauge steel members |
| CO2 | Able to understand design concepts of cold formed/unrestrained beams |
| CO3 | Able to understand Fire resistance concept required for present days. |
| CO4 | Able to analyze beam column behavior |
| **Course Outcomes** | **FINITE ELEMENT METHOD OF ANALYSIS - 22CSE22** |
| CO1 | Explain the basic theory behind the finite element method. |
| CO2 | Formulate force-displacements relations for 2-D elements |
| CO3 | Use the finite element method to analyze real structures. |
| CO4 | Use a Finite Element based program for structural analysis |
| **Course Outcomes** | **EARTHQUAKE RESISTANT STRUCTURES (Elective 1) - 22CSE233** |
| CO1 | Achieve Knowledge of design and development of problem solving skills. |
| CO2 | Understand the principles of engineering seismology. |
| CO3 | Design and develop analytical skills. |
| CO2 | Understand the concepts of earthquake resistance of reinforced concrete buildings. |
| CO4 | Summarize the Seismic evaluation and retrofitting of structures. |
| **Course Outcomes** | **DESIGN OF MASONRY STRUCTURES (Elective 2) - 22CSE243** |
| CO1 | Achieve Knowledge of design and development of problem solving skills. |
| CO2 | Understand the principles of design and construction of masonry structures |
| CO3 | Design and develop analytical skills |
| CO4 | Summarize the masonry Characteristics |
| CO5 | Evaluate the strength and stability of the masonry structures |
| **Course Outcomes** | **STRUCTURAL ENGINEERING LAB-2 -22CSEL26** |
| CO1 | Achieve Knowledge of design and development of programming skills. |
| CO2 | Understand the principles of structural analysis and design |
| CO3 | Design and develop analytical skills |
| CO4 | Summarize the performance of structures for static and dynamic forces. |
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| **Course Outcomes** | **DESIGN OF BRIDGES - 22CSE31** |
| CO1 | Describe historical growth, select ideal site and bridge, calculate values of design parameters of slab culvert at critical section as per IRC, design and detailing required for the execution of the project. |
| CO2 | Carry out analysis of box culvert as per IRC to obtain the values of design parameters and to design and detail the components following IS code procedure. |
| CO3 | Demonstrate the use of Pigeauds Method and Courbon's Methodin the analysis of T beam bridge as per IRC, design to obtain the safe dimensions various components, optimum reinforcement required following IS code procedure. |

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| CO4 | Display the use of Courbon's Methodin the analysis of PSC bridge as per IRC, design to obtain the safe value of pre stressing force, obtain the dimensions of various components to keep the stresses within codal provisions following IS code procedure. |
| CO 5 | Analysis a balanced cantilever bridge as per IRC and to obtain the safe values of design parameters and to design and detail the components as per IS code procedure |
| **Course Outcomes** | **DESIGN CONCEPTS OF SUBSTRUCTURES (Elective- 1) - 22CSE321** |
| CO1 | Achieve Knowledge of design and development of problem solving skills. |
| CO2 | Understand the principles of subsoil exploration. |
| CO3 | Design and develop analytical skills. |
| CO4 | Identify and evaluate the soil shear strength parameters. |
| CO5 | Understand the concepts of Settlement analysis. |
| **Course Outcomes** | **RETROFITTING AND REHABILITATION OF STRUCTURES (Elective 2) - 22CSE333** |
| CO1 | Achieve Knowledge of design and development of problem solving skills. |
| CO2 | Understand the cause of deterioration of concrete structures. |
| CO3 | Design and develop analytical skills. |
| CO4 | Summarize the principles of repair and rehabilitation of structures. |
| CO5 | Understands the concept of Serviceability and Durability. |
| **Course Outcomes** | **PROJECT WORK PHASE -2  - 22CSE41** |
| CO1 | Demonstrate a sound technical knowledge of their selected project topic. |
| CO2 | Undertake problem identification, formulation, and solution. |
| CO3 | Design engineering solutions to complex problems utilising a systems approach. |
| CO4 | Communicate with engineers and the community at large in written an oral forms. |
| CO5 | Demonstrate the knowledge, skills and attitudes of a professional engineer |

| Coarse Code | CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES - 21MAT31 |
|---|---|
| CO1 | To solve ordinary differential equations using Laplace transform. |
| CO2 | Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory. |
| CO3 | To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations |
| CO4 | To solve mathematical models represented by initial or boundary value problems involving partial differential equations |
| CO5 | Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis. |

| Coarse Code | GEODETIC ENGINEERING - 21CV32 |
|---|---|
| CO1 | Execute survey using compass and plane table |
| CO2 | Find the level of ground surface and Calculation of area and volumes |
| CO3 | Operate theodolite for field execution |
| CO4 | Estimate the capacity of reservoir |
| CO5 | Interpret satellite imageries |

| Coarse Code | STRENGTH OF MATERIALS - 21CV33 |
|---|---|
| CO1 | Evaluate the behavior when a solid material is subjected to various types of forces (namely Compressive, Tensile, Thermal, Shear, flexure, Torque, internal fluid pressure) and estimate stresses and corresponding strain developed. (L3) |
| CO2 | Estimate the forces developed and draw schematic diagram for stresses, forces, moments for simple beams with different types of support and are subjected to various types of loads (L3). |
| CO3 | Evaluate the behavior when a solid material is subjected to Torque and internal fluid pressure and estimate stresses and corresponding strain developed. (L3) |
| CO4 | . Distinguish the behavior of short and long column and calculate load at failure & explain the behavior of spring to estimate deflection and stiffness (L3) |
| CO5 | Examine and Evaluate the mechanical properties of various materials under different loading conditions |

| Coarse Code | EARTH RESOURCES AND ENGINEERING -  21CV34 |
|---|---|
| CO1 | Apply geological knowledge in different civil engineering practice. |
| CO2 | Students will acquire knowledge on durability and competence of foundation rocks, and confidence enough to use the best building materials. |
| CO3 | Competent enough to provide services for the safety, stability, economy and life of the structures that they construct |
| CO4 | Able to solve various issues related to ground water exploration, build up dams, bridges, tunnels which are often confronted with ground water problems |
| CO5 | Intelligent enough to apply GIS, GPS and remote sensing as a latest tool in different civil engineering for safe and solid construction. |

| Coarse Code | COMPUTER-AIDED BUILDING PLANNING AND DRAWING - 21CV35 |
|---|---|
| CO1 | Prepare, read and interpret the drawings in a professional set up. |
| CO2 | Know the procedures of submission of drawings and Develop working and submission drawings for building. |
| CO3 | Plan and design of residential or public building as per the given requirements. |

| Coarse Code | SOCIAL CONNECT AND RESPONSIBILITY– 21SCR33 |
|---|---|
| CO1 | The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem. |

| Coarse Code | FIRE SAFETY IN BUILDINGS -  21CV385 |
|---|---|
| CO1 | Understand types of fire, combustion process and fire resistance |
| CO2 | Plan for fire safety and design of lifts |
| CO3 | Design flow network in buildings |
| CO4 | Design of electrical systems and maintenance |
| CO5 | Perform health evaluation of buildings and suggest remedies |

| Coarse Code | COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS- 21MAT41 |
|---|---|
| CO1 | Use the concepts of an analytic function and complex potential to solve the problems arising in electromagnetic field theory. Utilize conformal transformation and complex integral arising in aerofoil theory, fluid visualization and image processing |
| CO2 | Obtain series solution of ordinary differential equation. |
| CO3 | Make use of the correlation and regression analysis to fit a suitable mathematical model for the statically data. |
| CO4 | Apply discrete and continues probability distribution in analyzing the probability model arising in the engineering field. |
| CO5 | Construct joint probability distribution and demonstration the validity of testing the hypothesis |

| Coarse Code | FLUID MECHANICS AND HYDRAULICS - 21CV42 |
|---|---|
| CO1 | Understand fundamental properties of fluids and solve problems on Hydrostatics |
| CO2 | Apply Principles of Mathematics to represent Kinematics and Bernoulli's principles |
| CO3 | Compute discharge through pipes, notches and weirs |
| CO3 | Design of open channels of various cross sections |
| CO3 | Design of turbines for the given data and understand their operation characteristics |

| Coarse Code | PUBLIC HEALTH ENGINEERING – 21CV43 |
|---|---|
| CO1 | Estimate average and peak water demand for a community. |
| CO2 | Evaluate water quality and environmental significance of various parameters and plan suitable treatment system. |
| CO3 | Design the different units of water treatment plant |
| CO4 | Understand and design the various units of wastewater treatment plant |
| CO5 | Acquire capability to conduct experiments and estimate the concentration of different parameters and compare the obtained results with the concerned guidelines and regulations. |

| Coarse Code | ANALYSIS OF STRUCTURES - 21CV44 |
|---|---|
| CO1 | Evaluate slope and deflections in beams using geometrical methods. |
| CO2 | Determine deflections in trusses and frames using energy principles. |
| CO3 | Analyse arches and cables for stress resultants. |

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| CO4 | Apply slope defection method in analysing indeterminate structures and construct bending moment diagram |
| CO5 | Analyse continuous beams, frames and trusses using stiffness matrix method of analysis. |
| **Coarse Code** | **EARTH RESOURCES AND ENGINEERING LABORATORY – 21BE45** |
| CO1 | Elucidate the basic biological concepts via relevant industrial applications and case studies |
| CO2 | Evaluate the principles of design and development, for exploring novel bioengineering projects. |
| CO3 | Corroborate the concepts of biomimetics for specific requirements. |
| CO4 | Think critically towards exploring innovative biobased solutions for socially relevant problems |
| **Coarse Code** | **EARTH RESOURCES AND ENGINEERING LABORATORY - 21CVL46** |
| CO1 | Comprehend the relations between minerals and rocks based on their physicalproperties |
| CO2 | Assessthe suitability of materials used in building construction |
| CO3 | Differentiate geological investigations necessary for the construction of dams, bridges,and tunnels |
| CO4 | Describe the groundwater investigation using resistivity methods |
| CO5 | Understand the applications of Geospatial technology in Civil Engineering |
| **Coarse Code** | **CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS (CIP) - 21CIP47** |
| CO1 | Have constitutional knowledge and legal literacy. |
| CO2 | Understand Engineering and Professional ethics and responsibilities of Engineers. |
| **Coarse Code** | **GREEN BUILDINGS -  21CV485** |
| CO1 | |
| **Coarse Code** | **UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY and ETHICAL HUMAN CONDUCT- 21UHV49** |
| CO1 | Holistic vision of life |
| CO2 | Socially responsible behaviour |
| CO3 | Environmentally responsible work |
| CO4 | Ethical human conduct |
| CO5 | Having Competence and Capabilities for Maintaining Health and Hygiene |
| CO6 | Appreciation and aspiration for excellence (merit) and gratitude for all |
| **Coarse Code** | **HYDROLOGY AND WATER RESOURCE ENGINEERING- 21CV51** |
| CO1 | Provide a background in the theory of hydrological processes and their measurement |
| CO2 | Estimate runoff and develop unit hydrographs. |
| CO3 | Find the water requirement and frequency of irrigation for various crops. |
| CO4 | Find the canal capacity and compute the reservoir capacity. |
| CO5 | Analyse floods and droughts. Emphasise on the importance of conservation of water and water bodies. |
| **Coarse Code** | **TRANSPORTATION ENGINEERING- 21CV52** |
| CO1 | Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data. |

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| CO2 | Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction |
| CO3 | Design road geometrics, structural components of pavement and drainage. |
| CO4 | Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts. |
| **Coarse Code** | **DESIGN OF RC STRUCTURAL ELEMENTS- 21CV53** |
| CO1 | Understand the design philosophy and principles. |
| CO2 | Solve engineering problems of RC elements subjected to flexure, shear and torsion. |
| CO3 | Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings. |
| CO4 | Owns professional and ethical responsibility. |
| **oarse Code** | **GEOTECHNICAL ENGINEERING– 21CV54** |
| CO1 | Determine the index properties of soil and hence classify the soil |
| CO2 | Assess the compaction and consolidation characteristics of soil |
| CO3 | Determine the permeability of soils and assess the seepage in hydraulic structures |
| CO4 | Evaluate shear parameters of the soil using shear tests |
| CO5 | Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure |
| **Coarse Code** | **GEOTECHNICAL ENGINEERING LABORATORY-  21CVL55** |
| CO1 | Physical and index properties of the soil |
| CO2 | Classify based on index properties and field identification |
| CO3 | To determine OMC and MDD, plan and assess field compaction program |
| CO4 | Shear strength and consolidation parameters to assess strength and deformation characteristics |
| CO5 | In-situ shear strength characteristics(SPT-Demonstration) |
| **Coarse Code** | **RESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS– 21CV56** |
| CO1 | To know the meaning of engineering research. |
| CO2 | To know the procedure of Literature Review and Technical Reading. |
| CO3 | To know the fundamentals of patent laws and drafting procedure. |
| CO4 | Understanding the copyright laws and subject matters of copyrights and designs |
| CO5 | Understanding the basic principal of desiring  Rights. |
| **Coarse Code** | **ENVIRONMENTAL STUDIES –  21CIV57** |
| CO1 | Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale, |
| CO2 | Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment. |
| CO3 | Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components. |
| CO4 | Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues. |
| **Coarse Code** | **GENDER SENSITISATION - 21CV583** |

| CO1 | Appreciate gender issues prevalent in the society |
|-----|---------------------------------------------------|
| CO2 | Value the role of each gender in family, society and state. |
| CO3 | Analyse the gender sensitivity at work place and evolve proper perception of the other gender |
| CO4 | Sensitise oneself towards gender equality |
| **Coarse Code** | **CONSTRUCTION MANAGEMENT AND ENTRPRENERSHIP – 21CV61** |
| CO1 | Understand various management principles of construction industry (L2) |
| CO2 | Use planning, organizing, scheduling, monitoring and controlling techniques for managing construction activity (L4) |
| CO3 | Understand importance of quality control and safety in construction.(L2) |
| CO4 | Understand managing data pertaining to construction project. (L4) |
| CO5 | Evaluate alternatives and develop capital budget for different scenarios. |
| **Coarse Code** | **CONCRETE TECHNOLOGY – 21CV62** |
| CO1 | Assess and infer various properties of cement, cementitious materials, Fine and coarse aggregate as per codal provision and specifications (L2) |
| CO2 | Design the concrete mix for the given materials as per IS:10262-2019 provisions (L4) |
| CO3 | Understand the manufacturing process and asses the quality of green (L2) |
| CO4 | Describe the properties of fresh and hardened concrete – Strength and Durability aspects (L3) |
| CO5 | Examine and Evaluate properties of Cement and Concrete |
| **Coarse Code** | **DESIGN OF STEEL STRUCTURAL ELEMENTS – 21CV63** |
| CO1 | Possess knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel. |
| CO2 | Understand the Concept of Bolted and Welded connections |
| CO3 | Understand the Concept of Design of compression members, built-up columns and columns splices |
| CO4 | Understand the Concept of Design of tension members, simple slab base and gusseted base. |
| CO5 | Understand the Concept of Design of laterally supported and un-supported steel beams. |
| **Coarse Code** | **DESIGN OF PRE-STRESSED CONCRETE STRUCTURES – 21CV641** |
| CO1 | Understand the requirement of PSC members for present scenario. |
| CO2 | Analyse the stresses encountered in PSC element during transfer and at working. |
| CO3 | Understand the effectiveness of the design of PSC after studying losses |
| CO4 | Capable of analyzing the PSC element and finding its efficiency. |
| CO5 | Design PSC beam for different requirements. |
| **Coarse Code** | **APPLIED GEOTECHNICAL ENGINEERING - 21CV642** |
| CO1 | Abilitytoplanandexecutegeotechnicalsiteinvestigationprogramfordifferentcivilengineeringprojects. |
| CO2 | Understandingofstressdistributionandresultingsettlementbeneaththeloadedfootingsonsandandclayeys oils. |
| CO3 | Abilitytoestimatefactorofsafetyagainstfailureofslopesandtocomputelateralpressuredistributi onbehind earth retaining structures. |
| CO4 | Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure. |

| CO5 | Capable of estimating load carrying capacity of single and group of piles. |
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| **Coarse Code** | **RAILWAYS, HARBOUR, TUNNELING AND AIRPORTS - 21CV643** |
| CO1 | Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway |
| CO2 | Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive |
| CO3 | Develop layout plan of airport, harbour, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same |
| CO4 | Apply the knowledge gained to conduct surveying, understand the tunnelling activities |
| **Coarse Code** | **DESIGN CONCEPTS IN BUILDING SERVICES - 21CV644** |
| CO1 | Describe the basics of house plumbing and waste water collection and disposal. |
| CO2 | Discuss the safety and guidelines with respect to fire safety. |
| CO3 | Describe the issues with respect to quantity of water, rain water harvesting and roof top harvesting. |
| CO4 | Understand and implement the requirements of thermal comfort in buildings |
| **Coarse Code** | **GROUNDWATER HYDRAULICS(Elective)  - 21CV645** |
| CO1 | Explain the importance of Groundwater |
| CO2 | Paraphrasing the Characteristics of aquifers |
| CO3 | Estimate the quantity of groundwater by various methods |
| CO4 | Analyse the zones of groundwater resource |
| CO5 | Analyse the quality of groundwater and understand Techniques of modeling |
| **Coarse Code** | **ALTERNATE BUILDING MATERIALS - 21CV646** |
| CO1 | Solve the problems of Environmental issues concerned to building materials and cost effective building technologies; |
| CO2 | Select appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression. |
| CO3 | Analyze different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material. |
| CO4 | Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material. |
| **Coarse Code** | **OCCUPATIONAL HEALTH AND SAFETY (Elective) - 21CV651** |
| CO1 | Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others. |
| CO2 | Control unsafe or unhealthy hazards and propose methods to eliminate the hazard |
| CO3 | Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation. |
| CO4 | Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors. |
| CO5 | Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety. |
| **Coarse Code** | **QUANTITY SURVEY AND CONTRACT MANAGEMENT - 21CV71** |
| CO1 | Develop the quantity estimates for different Civil Engineering structures, works & also communicate the cost abstract in a simple form to the stake holders. |

| | |
|---|---|
| CO2 | Prepare specifications of various Civil Engineering Structures/works, also will be able to analyse the requirement of a structure /work to arrive at a specific cost for completion of the same. |
| CO3 | Make use of minimum basic knowledge gained in this course to take up entrepreneurship/employment as a contractor. |
| **Coarse Code** | **CONSTRUCTION TECHNOLOGY FOR SUBSTRUCTURE & SUPERSTRUCTURES– 21CV72** |
| CO1 | Select Appropriate technology for underground constructions. |
| CO2 | Able to select appropriate pile construction method and testing of piles. |
| CO3 | Able to select appropriate concreting practices for different constructions |
| CO4 | Able to select appropriate underwater construction technology |
| **Coarse Code** | **ADVANCED DESIGN OF RCC AND STEEL STRUCTURES (Elective) - 21CV731** |
| CO1 | Students will acquire the basic knowledge in design of RCC and Steel Structures. |
| CO2 | Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members. |
| **Coarse Code** | **ADVANCED GEOTECHNICAL ENGINEERING (Elective) - 21CV732** |
| CO1 | Estimate the size of isolated and combined foundations to satisfy bearing capacity and settlement criteria |
| CO2 | Estimate the load carrying capacity and settlement of single piles and pile groups including laterally loaded piles. |
| CO3 | Understand the basics of analysis and design principles of well foundation, drilled piers and caissons. |
| CO4 | Understand basics of analysis and design principles of machine foundations. |
| **Coarse Code** | PAVEMENT MATERIALS AND CONSTRUCTION **(Elective) - 21CV733** |
| CO1 | Students will be able to evaluate and assess the suitability of any pavement material to be used in various components of pavement by conducting required tests as per IS, IRC specifications |
| CO2 | Students will be able to formulate the proportions of different sizes of aggregates to suit gradation criteria for various mixes as per MORTH and also design bituminous mixes. |
| CO3 | Students will be competent to adapt suitable modern technique and equipment for speedy and economic construction. |
| CO4 | Student will be able to execute the construction of embankment, flexible, rigid pavement and perform required quality control tests at different stages of pavement construction. |
| **Coarse Code** | **SOLID WASTE MANAGEMENT (Elective) - 21CV734** |
| CO1 | Identify improper practices of solid waste disposal and their environmental implications. Know the basic engineering principles of solid waste management |
| CO2 | Describe the need for economics in collection and transportation of solid waste and clearly discuss various types of collection systems and analyse system dynamics |
| CO3 | Understand the management concepts, define 4 R approach, apply PPP model and community involvement for effective management of solid waste |
| CO4 | Develop a concise idea on various conventional and advanced treatment options for solid waste |

| CO5 | Conceive the design aspects of engineered disposal options and apply the gained knowledge |
|---|---|
| **Coarse Code** | **GROUND IMPROVEMENT TECHNIQUES- 21CVL742** |
| CO1 | Give solutions to solve various problems associated with soil formations having less strength. |
| CO2 | Use effectively the various methods of ground improvement techniques depending upon the requirements. |
| CO3 | Utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures |
| **Coarse Code** | **ENVIRONMENTAL PROTECTION AND MANAGEMENT- 21CV753** |
| CO1 | Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards |
| CO2 | Lead pollution prevention assessment team and implement waste minimization options |
| CO3 | Develop, Implement, maintain and Audit Environmental Management systems for Organisations |

| Course Outcomes | ADVANCED STRUCTURAL ANALYSIS- 20CSE11 |
|---|---|
| CO1 | Apply Winkler Bach and Strain Energy principles to obtain stresses and deformation in curved members |
| CO2 | Derive the expressions to Foundation pressure, Deflection, Slope, BM and SF of infinite and semi-infinite Beams resting on Elastic Foundation |
| CO3 | Obtain the equations for the shear centre for symmetrical and unsymmetrical from fundamental. |
| CO4 | Extrapolate the bending theory to calculate the stresses and deformations in unsymmetrical bending |
| CO5 | Develop the characteristic equation for the buckling load of compound column and stresses and deformations in beam-column |
| Course Outcomes | MATRIX METHODS OF STRUCTURAL ANALYSIS- 20CSE12 |
| CO1 | Formulate force displacement relation by flexibility and stiffness method |
| CO2 | Analyze the plane trusses, continuous beams and portal frames by transformation approach |
| CO3 | Analyse the structures by direct stiffness method |
| Course Outcomes | Advanced design of RCC structures - 20CSE13 |
| CO1 | Achieve Knowledge of design and development of problem solving skills. |
| CO2 | Understand the principles of Structural Design |
| CO3 | Design and develop analytical skills. |
| CO4 | Summarize the principles of Structural Design and detailing |
| CO5 | Understands the structural performance. |
| Course Outcomes | MECHANICS OF DEFORMABLE BODIES -  20CSE14 |
| CO1 | Achieve Knowledge of design and development of problem solving skills |
| CO2 | Understand the principles of stress-strain behaviour of continuum |
| CO3 | Design and develop analytical skills |
| CO4 | Describe the continuum in 2 and 3- dimensions |
| CO5 | Understand the concepts of elasticity and plasticity. |
| Course Outcomes | STRUCTURAL DYNAMICS – 20CSE15 |
| CO1 | Achieve Knowledge of design and development of problem solving skills. |
| CO2 | Understand the principles of Structural Dynamics |
| CO3 | Design and develop analytical skills. |
| CO4 | Summarize the Solution techniques for dynamics of Multi-degree freedom systems |
| CO5 | Understand the concepts of damping in structures. |
| Course Outcomes | Structural engineering lab 1 -20CSEL16 |
| CO1 | Achieve Knowledge of design and development of experimenting skills. |
| CO2 | Understand the principles of design of experiments |
| CO3 | Design and develop analytical skills. |
| CO4 | Summarize the testing methods and equipments. |
| Course Outcomes | RESEARCH METHODOLOGY AND IPR -20RMI17 |
| CO1 | Discuss research methodology and the technique of defining a research problem |

| CO2 | Explain the functions of the literature review in research, carrying out a literature search, developing |
|---|---|
| CO3 | Explain various research designs and their characteristics. |
| CO4 | Explain the art of interpretation and the art of writing research reports |
| CO5 | Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR |

| Course Outcomes | ADVANCED DESIGN OF STEEL STRUCTURES - 20CSE21 |
|---|---|
| CO1 | Able to understand behavior of Light gauge steel members |
| CO2 | Able to understand design concepts of cold formed/unrestrained beams |
| CO3 | Able to understand Fire resistance concept required for present days. |
| CO4 | Able to analyze beam column behavior |

| Course Outcomes | FINITE ELEMENT METHOD OF ANALYSIS - 20CSE22 |
|---|---|
| CO1 | Explain the basic theory behind the finite element method. |
| CO2 | Formulate force-displacements relations for 2-D elements |
| CO3 | Use the finite element method to analyze real structures. |
| CO4 | Use a Finite Element based program for structural analysis |

| Course Outcomes | EARTHQUAKE RESISTANT STRUCTURES - 20CSE23 |
|---|---|
| CO1 | Achieve Knowledge of design and development of problem solving skills. |
| CO2 | Understand the principles of engineering seismology and concepts of earthquake resistance of reinforced concrete buildings. |
| CO3 | Design and develop analytical skills. |
| CO2 | Understand the concepts of earthquake resistance of reinforced concrete buildings. |
| CO4 | Summarize the Seismic evaluation and retrofitting of structures. |

| Course Outcomes | ADVANCED DESIGN OF PRE- STRESSED CONCRETE STRUCTURES (Elective 1) - 20CSE242 |
|---|---|
| CO1 | Analyse , Design and detail PSC elements |

| Course Outcomes | ADVANCED STRUCTURAL ANALYSIS (Elective 2) - 18CSE251 |
|---|---|
| CO1 | Apply Winkler Bach and Strain Energy principles to obtain stresses and deformation in curved members |
| CO2 | Derive the expressions to Foundation pressure, Deflection, Slope, BM and SF of infinite and semi-infinite Beams resting on Elastic Foundation |
| CO3 | Obtain the equations for the shear centre for symmetrical and unsymmetrical from fundamental |
| CO4 | Extrapolate the bending theory to calculate the stresses and deformations in unsymmetrical bending |
| CO5 | Develop the characteristic equation for the buckling load of compound column and stresses and deformations in beam-column |

| Course Outcomes | DESIGN OF TALL STRUCTURES (Elective 2) - 20CSE252 |
|---|---|
| CO1 | Achieve Knowledge of design and development of problem solving skills. |
| CO2 | Understand the principles of strength and stability |
| CO3 | Design and develop analytical skills. |
| CO4 | Summarize the behavior of various structural systems. |
| CO5 | Understand the concepts of P-Delta analysis |

| Course Outcomes | STRUCTURAL ENGINEERING LAB-2 -20CSEL26 |
|---|---|
| CO1 | Achieve Knowledge of design and development of programming skills. |
| CO2 | Understand the principles of structural analysis and design |
| CO3 | Design and develop analytical skills |
| CO4 | Summarize the performance of structures for static and dynamic forces. |
| Course Outcomes | DESIGN OF BRIDGES - 20CSE31 |
| CO1 | Describe historical growth, select ideal site and bridge, calculate values of design parameters of slab culvert at critical section as per IRC, design and detailing required for the execution of the project. |
| CO2 | Carry out analysis of box culvert as per IRC to obtain the values of design parameters and to design and detail the components following IS code procedure. |
| CO3 | Demonstrate the use of Pigeauds Method and Courbon's Methodin the analysis of T beam bridge as per IRC, design to obtain the safe dimensions various components, optimum reinforcement required following IS code procedure. |
| CO4 | Display the use of Courbon's Methodin the analysis of PSC bridge as per IRC, design to obtain the safe value of pre stressing force, obtain the dimensions of various components to keep the stresses within codal provisions following IS code procedure. |
| CO 5 | Analysis a balanced cantilever bridge as per IRC and to obtain the safe values of design parameters and to design and detail the components as per IS code procedure |
| Course Outcomes | DESIGN CONCEPTS OF SUBSTRUCTURES (Elective- 1) - 20CSE321 |
| CO1 | Achieve Knowledge of design and development of problem solving skills |
| CO2 | Understand the principles of subsoil exploration |
| CO3 | Design and develop analytical skills. |
| CO4 | Understand the concepts of Settlement analysis. |
| Course Outcomes | FRACTURE MECHANICS APPLIED TO CONCRETE (Elective 2) - 20CSE331 |
| CO1 | Apply principles of fracture mechanics. |
| CO2 | Design concrete structures using fracture mechanics approach. |
| CO3 | Explain the importance of fracture mechanics. |
| CO4 | Take special care of very large sized structures |
| Course Outcomes | PROJECT WORK PHASE -2  - 20CSE41 |

# PROGRAMME OUTCOME, PROGRAMMESPECIFIC OUTCOMES AND COURSEOUTCOMES OF ALL DEPARTMENTS–2023-24(CRITERIA- 2)
## Department of Computer Science & Engineering

**Program Outcomes (PO's)**

**PO 1:** Apply the knowledge of Mathematics, Science and Computer Engineering to identify, formulate and solve any engineering problems with varied complexity.

**PO 2:** Design and develop a system, component or process to meet the desired needs within the realistic constraints to solve the real-time problems for betterment of society.

**PO 3:** Design and conduct experiments as well as analyze and interpret data.

**PO 4:** Communicate and Present the information effectively.

**PO 5:** Use the techniques, skills and modern engineering tools necessary for engineering practice.

**PO 6:** Handle various technical, administrative and managerial responsibilities successfully in any organizations globally.

**PO 7:** Get Recognize as successful Entrepreneur globally.

**PO 8:** Demonstrate commitment in handling any responsibilities with professional, ethical and social importance.

**PO 9:** Engage in lifelong learning to upgrade their engineering skills consistently.

**PO 10:** Adapt to any working environment of heterogeneous and multidisciplinary teams with good sustainability and high performance.

**PO 11:** Clear successfully the competitive exams for placement, higher studies and government services.

**PO 12:** Understand and demonstrate the impact of engineering solutions in a global , economic , environmental and societal context.

**Program Specific Outcomes (PSO's)**

**PSO 1:** An ability to design and develop hardware and software in emerging technology environments like cloud computing embedded products and real-time systems. (Orientation towards Systems Programming)

**PSO 2:** Knowledge of data management system like data acquisition, big data so as to enable students in solving problems using the techniques of data analytics like pattern recognition and knowledge discovery. (Orientation towards Data Sciences)

# UG-B.E (CS) 2022-Scheme COs

## DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

| COURSE CODE | BPOPS103/203-PRINCIPLES OF PROGRAMMING USING C |
|---|---|
| CO1 | Elucidate the basic architecture and functionalities of a computer and also recognize the hardware parts |
| CO2 | Apply programming constructs of C language to solve the realworld problem |
| CO3 | Explore user-defined data structures like arrays in implementing solutions to problems like searching and sorting |
| CO4 | Explore user-defined data structures like structures, unions and pointers in implementing solutions |
| CO5 | Design and Develop Solutions to problems using modularprogramming constructs using functions |

| COURSE CODE | BPLCK105B/205B-INTRODUCTION TO PYTHONPROGRAMMING |
|---|---|
| CO1 | Demonstrate proficiency in handling loops and creation offunctions. |
| CO2 | Identify the methods to create and manipulate lists, tuples anddictionaries. |
| CO3 | Develop programs for string processing and file organization |
| CO4 | Interpret the concepts of Object-Oriented Programming as used in Python. |

| COURSE CODE | BCS302-DIGITAL DESIGN AND COMPUTERORGANIZATION |
|---|---|
| CO1 | Apply the K–Map techniques to simplify various Boolean expressions. |
| CO2 | Design different types of combinational and sequential circuits along with Verilog programs. |
| CO3 | Describe the fundamentals of machine instructions, addressing modes and Processor performance |
| CO4 | Explain the approaches involved in achieving communication between processor and I/O devices |
| CO5 | Analyze internal Organization of Memory and Impact of cache/Pipelining on Processor Performance. |

| COURSE CODE | BCS303-OPERATING SYSTEMS |
|---|---|
| CO1 | Explain the structure and functionality of operating system |
| CO2 | Apply appropriate CPU scheduling algorithms for the given problem. |
| CO3 | Analyse the various techniques for process synchronization and deadlock handling. |
| CO4 | Apply the various techniques for memory management |
| CO5 | Explain file and secondary storage management strategies |
| CO6 | Describe the need for information protection mechanisms. |

| COURSE CODE | BCS304-DATA STRUCTURES AND APPLICATIONS |
|---|---|
| CO1 | Explain different data structures and their applications. |
| CO2 | Apply Arrays, Stacks and Queue data structures to solve the given problems. |
| CO3 | Use the concept of linked list in problem solving. |
| CO4 | Develop solutions using trees and graphs to model the real-world problem. |
| CO5 | Explain the advanced Data Structures concepts such as Hashing Techniques and Optimal Binary Search Trees. |

| COURSE CODE | BCSL305-DATA STRUCTURES LABORATORY |
|---|---|
| CO1 | Analyze various linear and non-linear data structures |
| CO2 | Demonstrate the working nature of different types of data structures and their applications |
| CO3 | Use appropriate searching and sorting algorithms for the give scenario |
| CO4 | Apply the appropriate data structure for solving real world problems |

| COURSE CODE | BCS306A-OBJECT ORIENTED PROGRAMMING WITH JAVA |
|---|---|
| CO1 | Demonstrate proficiency in writing simple programs involving branching and looping structures. |
| CO2 | Design a class involving data members and methods for the given scenario. |
| CO3 | Apply the concepts of inheritance and interfaces in solving real world problems. |
| CO4 | Use the concept of packages and exception handling in solving complex problem |
| CO5 | Apply concepts of multithreading, autoboxing and enumerations in program development |

| COURSE CODE | BCS306B-OBJECT ORIENTED PROGRAMMING with C++ |
|---|---|
| CO1 | Illustrate the basic concepts of object-oriented programming. |
| CO2 | Design appropriate classes for the given real world scenario. |
| CO3 | Apply the knowledge of compile-time / run-time polymorphism to solve the given problem |
| CO4 | Use the knowledge of inheritance for developing optimized solutions |
| CO5 | Apply the concepts of templates and exception handling for the given problem |
| CO6 | Use the concepts of input output streams for file operations |

| COURSE CODE | BSCK307-SOCIAL Connect & Responsibility |
|---|---|
| CO1 | Communicate and connect to the surrounding. |

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|---|---|
| **CO2** | Create a responsible connection with the society. |
| **CO3** | Involve in the community in general in which they work. |
| **CO4** | Notice the needs and problems of the community and involve them in problem –solving. |
| **CO5** | Develop among them a sense of social & civic responsibility & utilize their knowledge I finding practical solutions toindividual and community problems. |
| **CO6** | Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democraticattitudes. |
| **COURSE CODE** | **BCS358A-DATA ANALYTICS WITH EXCEL** |
| **CO1** | Use advanced functions and productivity tools to assist in developing worksheets. |
| **CO2** | Manipulate data lists using Outline and PivotTables |
| **CO3** | Use Consolidation to summarize and report results from multiple worksheets. |
| **CO4** | Apply Macros and Auto filter to solve the given real world scenario. |
| **COURSE CODE** | **BCS358B-R PROGRAMMING** |
| **CO1** | Explain the fundamental syntax of R data types, expressions and the usage of the R-Studio IDE |
| **CO2** | Develop a program in R with programming constructs:conditionals, looping functions |
| **CO3** | Apply the list and data frame structure of the R programminglanguage. |
| **CO4** | Use visualization packages and file handlers for data analysis. |
| **COURSE CODE** | **BCS358C-PROJECT MANAGEMENT WITH GIT** |
| **CO1** | Use the basics commands related to git repository |
| **CO2** | Create and manage the branches |
| **CO3** | Apply commands related to Collaboration and Remote Repositories |
| **CO4** | Use the commands related to Git Tags, Releases and advanced git operations |
| **CO5** | Analyse and change the git history |
| **COURSE CODE** | **BCS358D-DATA VISUALIZATION WITH PYTHON** |
| **CO1** | Demonstrate the use of IDLE or PyCharm IDE to create Python Applications |
| **CO2** | . Use Python programming constructs to develop programs for solving real-world problems |
| **CO3** | Use Mat plot lib for drawing different Plots |
| **CO4** | Demonstrate working with Seaborn, Bokeh for visualization. |
| **CO5** | Use Plotly for drawing Time Series and Maps. |

# PG-M.Tech (SCS) 2022-Scheme COs

| DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING | |
|---|---|
| **COURSE CODE** | **22SCS11-MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE** |
| CO1 | Understand vector spaces and related topics arising in magnification and rotation of images. |
| CO2 | Compute orthogonal and orthonormal basis vectors required to analyze image and signal L2& L3 Processing problems |
| CO3 | Apply the technique of singular value decomposition for data compression, least square L2 &L3 approximation in solving in consistent linear systems |
| CO4 | Understand probabilistic concepts required to test the hypothesis and take decision using. Analysis of variance. |
| CO5 | Understand one and two dimensional Fourier transform |
| **COURSE CODE** | **22SCS12-FUNDAMENTALS OF DATA SCIENCES** |
| CO1 | Explain and programme Data Science, Big data and fitting model. |
| CO2 | Explore Data Analysis, Data Science Process and R Programs for the algorithms. |
| CO3 | Analyze the Feature Selection algorithms and Recommendation Systems |
| CO4 | Design Map Reduce Solutions |
| **COURSE CODE** | **22SCS13-ADVANCES IN COMPUTER NETWORKS** |
| CO1 | List and classify network services, protocols and architectures, explain why they are layered. |
| CO2 | Choose key Internet applications and their protocols and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API. |
| CO3 | Develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc |
| **COURSE CODE** | **22SCS14-INTERNET OF THINGS AND APPLICATIONS** |
| CO1 | Develop schemes for the applications of IOT in real time scenarios |
| CO2 | Manage the Internet resources |
| CO3 | Model the Internet of things to business |
| CO4 | Interpret data sets received through IoT devices and tools used for analysis |
| **COURSE CODE** | **22SCS15-ADVANCED ALGORITHMS** |
| CO1 | Apply iterative and recursive algorithms |
| CO2 | Work optimization algorithms in specific applications |
| CO3 | Choose appropriately shared objects and concurrent objects for applications. |
| **COURSE CODE** | **22RMI16-RESEARCH METHODOLOGY AND IPR** |
| CO1 | Conduct research independently |
| CO2 | Choose research designs, sampling designs, measurement and scaling techniques and also different methods of data collections |
| CO3 | Statistically interpret the data and draw inferences |
| **COURSE CODE** | **22SCS17-INTERNET OF THINGS LABORATORY** |
| CO1 | Apply key Internet applications and their protocols, and ability to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API. |
| CO2 | Design and evaluate application layer protocol |
| CO3 | Analyze the vulnerabilities in any computing system and hence be able to design a security solution. |
| CO4 | Identify the security issues in the network and resolve it |
| CO5 | Evaluate security mechanisms using rigorous approaches, including theoretical |
| **COURSE CODE** | **22SCS21-BIG DATA ANALYTICS** |
| CO1 | Interpret managing big data using Hadoop and SPARK technologies |
| CO2 | Explain HDFS and MapReduce concepts |
| CO3 | Install, configure, and run Hadoop and HDFS |

| | |
|---|---|
| **CO4** | Perform map-reduce analytics using Hadoop and related tools |
| **CO5** | Explain SPARK concepts |
| **COURSE CODE** | **22SCS22-ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING** |
| **CO1** | Define Artificial intelligence and identify problems for AI. Characterize the searchtechniques to solve problems and recognize the scope of classical search techniques |
| **CO2** | Define knowledge and its role in AI. Demonstrate the use of Logic in solving AI problems |
| **CO3** | Demonstrate handling of uncertain knowledge and reasoning in probability theory. |
| **COURSE CODE** | **22SCS231-WIRELESS NETWORKS & MOBILE COMPUTING** |
| **CO1** | Explain state of art techniques in wireless communication |
| **CO2** | Discover CDMA, GSM. Mobile IP, WiMAX |
| **CO3** | Demonstrate program for CLDC, MIDP let model and security concerns |
| **COURSE CODE** | **22SCS232-MOBILE APPLICATION DEVELOPMENT** |
| **CO1** | Describe the requirements for mobile applications |
| **CO2** | Explain the challenges in mobile application design and development |
| **CO3** | Deploy mobile applications in Android and iPone marketplace for distribution |
| **COURSE CODE** | **22SCS233-NATURAL LANGUAGE PROCESSING** |
| **CO1** | Analyze the natural language text. |
| **CO2** | Generate the natural language. |
| **CO3** | Demonstrate Text mining. |
| **COURSE CODE** | **22SCS234-CYBER SECURITY AND CYBER LAW** |
| **CO1** | Demonstrate cyber security cybercrime and forensics |
| **CO2** | Demonstrate tools and methods used in cybercrime and security |
| **CO3** | Illustrate evidence collection and legal challenges |
| **COURSE CODE** | **22SCS235-DECISION SUPPORT SYSTEM** |
| **CO1** | Appraise issues related to the development of DSS |
| **CO2** | Select appropriate modeling techniques |
| **CO3** | Analyze, design and implement a DSS |
| **COURSE CODE** | **22SCS241-DIGITAL IMAGE PROCESSING** |
| **CO1** | Explain the basics and fundamentals of digital image processing, such asdigitization sampling, quantization, and 2D-transforms |
| **CO2** | Operate on images using the techniques of smoothing, sharpening and enhancement |
| **CO3** | Interpret the basics of segmentation, features extraction, compression and recognition methods for color models |
| **COURSE CODE** | **22SCS24-OBJECT ORIENTED DESIGN** |
| **CO1** | Identify the heuristics of the object-oriented programming |
| **CO2** | Explain the fundamentals of OOP |
| **CO3** | Examine fine object-oriented relations |
| **CO4** | Explain the role of Physical Object-Oriented Design, |
| **CO5** | Make use of Heuristics in The Use of Heuristics in Object-Oriented Design |
| **COURSE CODE** | **22SCS243-MULTIMEDIA COMMUNICATIONS** |
| **CO1** | Deploy the right multimedia communication models |
| **CO2** | Apply QoS to multimedia network applications with efficient routing techniques |
| **CO3** | Solve the security threats in the multimedia networks |
| **CO4** | Work on real-time multimedia network applications |
| **COURSE CODE** | **22SCS244-AGILE TECHNOLOGIES** |
| **CO1** | Define XP Lifecycle, XP Concepts, Adopting XP |
| **CO2** | Examine on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests |
| **CO3** | Demonstrate concepts to Eliminate Waste |
| **COURSE CODE** | **22SCS24-NOSQL DATABASE** |
| **CO1** | Explain NoSQL Key/Value databases using riak. |
| **CO2** | Apply Nosql Development tools with suitable usecase |
| **CO3** | Explain the detailed architecture and performance tune of Graph NoSQL databases |

| COURSE CODE | 22SCSL2-BIG DATA ANALYTICS LABORATORY |
|---|---|
| CO1 | Professional Skills: The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-basedsystems of varying complexity |
| CO2 | Problem-Solving Skills: The ability to apply standard practices and strategies insoftware project development using open-ended programming environments to deliver a quality product for business success |
| CO3 | Successful Career and Entrepreneurship: The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to bean entrepreneur, and a zest for higher studies |
| COURSE CODE | 22SCS321-CLOUD SECURITY |
| CO1 | Demonstrate the growth of Cloud computing, architecture and different modules of implementation |
| CO2 | Explain the different types of cloud solutions among IaaS, PaaS, SaaS |
| CO3 | Access the security implementation flow, actions and responsibilities of stake holders. |
| CO4 | Compare the Data Centre operations, encryption methods and deployment details |
| CO5 | Provide recommendations for using and managing the customer's identity and choose the type of virtualization to be used |
| COURSE CODE | 22SCS322-CYBER FORENSICS |
| CO1 | Explain the basics of computer forensics |
| CO2 | Apply a number of different computer forensic tools to a given scenario |
| CO3 | Analyze and validate forensics data |
| CO4 | Identify the vulnerabilities in a given network infrastructure |
| CO5 | Implement real-world hacking techniques to test system security |
| COURSE CODE | 22SCS323-SOFT AND EVOLUTIONARY COMPUTING |
| CO1 | Demonstrate the working of soft computing techniques |
| CO2 | Apply the learned techniques to solve realistic problems |
| CO3 | Differentiate soft computing with hard computing techniques |
| COURSE CODE | ADVANCES IN STORAGE AREA NETWORK |
| CO1 | Identify the need for performance evaluation and the metrics used for it |
| CO2 | Apply the techniques used for data maintenance. |
| CO3 | Realize strong virtualization concepts |
| CO4 | Illustrate RAID concepts, policies for LUN masking, file systems |
| COURSE CODE | 22SCS325-BUSINESS INTELLIGENCE AND ITS APPLICATIONS |
| CO1 | Explain the complete life cycle of BI/Analytical development |
| CO2 | Illustrate technology and processes associated with Business Intelligence framework |
| CO3 | Demonstrate a business scenario, identify the metrics, indicators and make L2 recommendations to achieve the business goa |
| COURSE CODE | 22SCS331-MANAGING BIG DATA |
| CO1 | Managing big data using Hadoop and SPARK technologies |
| CO2 | Explain HDFS and MapReduce concepts |
| CO3 | Install, configure, and run Hadoop and HDFS |
| CO4 | Apply Big Data Solutions using Hadoop Eco System |
| COURSE CODE | 22SCS332-PATTERN RECOGNITION |
| CO1 | Choose appropriate algorithms for Pattern Recognition. |
| CO2 | Apply nearest neighbour classifier. |
| CO3 | Apply Decision tree and clustering techniques to various applications |
| CO4 | Get acquainted with recent developments in pattern recognition and itsapplications |
| COURSE CODE | 22SCS333-COMPUTER VISION |
| CO1 | Implement fundamental image processing techniques required for computer vision. |
| CO2 | Perform shape analysis |
| CO3 | Implement boundary tracking techniques |
| CO4 | Apply chain codes and other region descriptors |
| COURSE CODE | 22SCS334-DEEP LEARNING |
| CO1 | Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains. |
| CO2 | Implement deep learning algorithms and solve real-world problems. |

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|---|---|
| **CO3** | Execute performance metrics of Deep Learning Techniques. |
| **CO4** | Compare modeling aspects of various neural network architectures |
| **COURSE CODE** | **22SCS335-BLOCKCHAIN TECHNOLOGY** |
| **CO1** | Explore the emerging abstract models for Blockchain Technology and to familiarise with the functional/operational concepts |
| **CO2** | Analyze the various consensus mechanisms, applications, research challenges and future directions |
| **CO3** | Practical implementation of Blockchain operations and solutions using Ethereum |
| **COURSE CODE** | **22SCS34-PROJECT WORK PHASE – 1** |
| **CO1** | Demonstrate a sound technical knowledge of their selected project topic |
| **CO2** | Undertake problem identification, formulation, and solution |
| **CO3** | Design engineering solutions to complex problems utilising a systems approach |
| **CO4** | Communicate with engineers and the community at large in written an oral forms |
| **CO5** | Demonstrate the knowledge, skills and attitudes of a professional engineer |
| **COURSE CODE** | **22SCS35-SOCIETAL PROJECT** |
| **CO1** | Build creative solutions for development problems of current scenario in the Society |
| **CO2** | Utilize the skills developed in the curriculum to solve real life problems |
| **CO3** | Improve understanding and develop methodology for solving complex issues |
| **COURSE CODE** | **22SCS36-INTERNSHIP / PROFESSIONAL PRACTICE** |
| **CO1** | Gain practical experience within industry in which the internship is done |
| **CO2** | Acquire knowledge of the industry in which the internship is done. |
| **CO3** | Apply knowledge and skills learned to classroom work |
| **COURSE CODE** | **22SCS41-PROJECT WORK PHASE -2** |
| **CO1** | Present the project and be able to defend it |
| **CO2** | Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task |
| **CO3** | Habituated to critical thinking and use problem solving skills |
| **CO4** | Communicate effectively and to present ideas clearly and coherently in both thewritten and ora forms |
| **CO5** | Work in a team to achieve common goal. |
| **CO6** | Learn on their own, reflect on their learning and take appropriate actions to improve it |

# UG-B.E (CS)2021-Scheme COs

| DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING | |
|---|---|
| **COURSE CODE** | **21PSP23/13 -PROBLEM-SOLVING THROUGH PROGRAMMING** |
| CO1 | Elucidate the basic architecture and functionalities of a computer and also recognize the hardware parts. |
| CO2 | Apply programming constructs of C language to solve the real world problem |
| CO3 | Explore user-defined data structures like arrays in implementing solutions to problems like searching and sorting |
| CO4 | Explore user-defined data structures like structures, unions and pointers in implementing solutions |
| CO5 | Design and Develop Solutions to problems using modular programming constructs using functions |
| **COURSE CODE** | **21CS32-DATA STRUCTURES AND APPLICATIONS** |
| CO1 | Identify different data structures and their applications |
| CO2 | Apply stack and queues in solving problems. |
| CO3 | Demonstrate applications of linked list. |
| CO4 | Explore the applications of trees and graphs to model and solve the real-world problem |
| CO5 | Make use of Hashing techniques and resolve collisions during mapping of key value pairs |
| **COURSE CODE** | **21CS33-ANALOG AND DIGITAL ELECTRONICS** |
| CO1 | Design and analyze application of analog circuits using photo devices, timer IC, power supplyand regulator IC and op-amp |
| CO2 | Explain the basic principles of A/D and D/A conversion circuits and develop the same |
| CO3 | Simplify digital circuits using Karnaugh Map, and Quine-McClusky Methods |
| CO4 | Explain Gates and flip flops and make us in designing different data processing circuits,registers and counters and compare the types. |
| CO5 | Develop simple HDL programs |
| **COURSE CODE** | **21CS34 -COMPUTER ORGANIZATION AND ARCHITECTURE** |
| CO1 | Explain the organization and architecture of computer systems with machine instructions andprograms |
| CO2 | Analyze the input/output devices communicating with computer system |
| CO3 | Demonstrate the functions of different types of memory devices |
| CO4 | Apply different data types on simple arithmetic and logical unit |
| CO5 | Analyze the functions of basic processing unit, Parallel processing and pipelining |
| **COURSE CODE** | **21CSL35-OBJECT ORIENTED PROGRAMMING WITH JAVA LABORATORY** |
| CO1 | Use Eclipse/NetBeans IDE to design, develop, debug Java Projects |
| CO2 | Analyze the necessity for Object Oriented Programming paradigm over structured programming and become familiar with the fundamental concepts in OOP. |
| CO3 | Demonstrate the ability to design and develop java programs, analyze, and interpret object-oriented data and document results |
| CO4 | Apply the concepts of multiprogramming, exception/event handling, abstraction to developrobust programs |
| CO5 | Develop user friendly applications using File I/O and GUI concepts. |

| COURSE CODE | 21CSL381-MASTERING OFFICE |
|---|---|
| CO1 | Know the basics of computers and prepare documents, spreadsheets, make small presentations with audio, video and graphs and would be acquainted with internet |
| CO2 | Create, edit, save and print documents with list tables, header, footer, graphic, spellchecker, mail merge and grammar checker |
| CO3 | Attain the knowledge about spreadsheet with formula, macros spell checker etc |
| CO4 | Demonstrate the ability to apply application software in an office environment |
| CO5 | Use Google Suite for office data management tasks |
| COURSE CODE | 21CS382-PROGRAMMING IN C++ |
| CO1 | Able to understand and design the solution to a problem using object-oriented programming concepts |
| CO2 | Able to reuse the code with extensible Class types, User-defined operators and function Overloading |
| CO3 | Achieve code reusability and extensibility by means of Inheritance and Polymorphism |
| CO4 | Identify and explore the Performance analysis of I/O Streams |
| CO5 | Implement the features of C++ including templates,exceptions and file handling for providing programmed solutions to complex problems |
| COURSE CODE | 21CS42-DESIGN AND ANALYSIS OF ALGORITHMS |
| CO1 | Analyze the performance of the algorithms, state the efficiency using asymptotic notations andanalyze mathematically the complexity of the algorithm |
| CO2 | Apply divide and conquer approaches and decrease and conquer approaches in solving theproblems analyze the same |
| CO3 | Apply the appropriate algorithmic design technique like greedy method, transform and conquer approaches and compare the efficiency of algorithms to solve the given problem |
| CO4 | Apply and analyze dynamic programming approaches to solve some problems. and improve analgorithm time efficiency by sacrificing space |
| CO5 | Apply and analyze backtracking, branch and bound methods and to describe P, NP and NP-Complete problems |
| COURSE CODE | 21CS43-MICROCONTROLLER AND EMBEDDED SYSTEMS |
| CO1 | Explain C-Compilers and optimization |
| CO2 | Describe the ARM microcontroller's architectural features and program module |
| CO3 | Apply the knowledge gained from programming on ARM to different applications |
| CO4 | Program the basic hardware components and their application selection method |
| CO5 | Demonstrate the need for a real-time operating system for embedded system applications |
| COURSE CODE | 21CS44-OPERATING SYSTEMS |
| CO1 | Identify the structure of an operating system and its scheduling mechanism |
| CO2 | Demonstrate the allocation of resources for a process using scheduling algorithm |
| CO3 | Identify root causes of deadlock and provide the solution for deadlock elimination |
| CO4 | Explore about the storage structures and learn about the Linux Operating system |
| CO5 | Analyze Storage Structures and Implement Customized Case study |

| COURSE CODE | 21CSL46-PYTHON PROGRAMMING LABORATORY |
|---|---|
| CO1 | Demonstrate proficiency in handling of loops and creation of functions |
| CO2 | Identify the methods to create and manipulate lists, tuples and dictionaries |
| CO3 | Discover the commonly used operations involving regular expressions and file system |
| CO4 | Interpret the concepts of Object-Oriented Programming as used in Python |
| CO5 | Determine the need for scraping websites and working with PDF, JSON and other file formats |
| COURSE CODE | 21CSL481-WEB PROGRAMMING |
| CO1 | Describe the fundamentals of web and concept of HTML |
| CO2 | Use the concepts of HTML, XHTML to construct the web pages |
| CO3 | Interpret CSS for dynamic documents |
| CO4 | Evaluate different concepts of JavaScript & Construct dynamic documents |
| CO5 | Design a small project with JavaScript and XHTML |
| COURSE CODE | 21CS482-UNIX SHELL PROGRAMMING |
| CO1 | Know the basics of Unix concepts and commands |
| CO2 | Evaluate the UNIX file system |
| CO3 | Apply Changes in file system |
| CO4 | Understand scripts and programs |
| CO5 | Analyze Facility with UNIX system process |
| COURSE CODE | 21CSL483-R PROGRAMMING |
| CO1 | To understand the fundamental syntax of R through readings, practice exercises, CO 2. |
| CO2 | To demonstrations, and writing R code. |
| CO3 | To apply critical programming language concepts such as data types, iteration |
| CO4 | To understand control structures, functions, and Boolean operators by writing R programsand through examples |
| CO5 | To import a variety of data formats into R using R-Studio |
| CO6 | To prepare or tidy data for in preparation for analyze |
| COURSE CODE | 21CS51-AUTOMATA THEORY AND COMPILER DESIGN |
| CO1 | Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation |
| CO2 | Design and develop lexical analyzers, parsers and code generators |
| CO3 | Design Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and the irrelative  powers |
| CO4 | Acquire fundamental understanding of the structure of a Compiler and Apply Concepts automata theory and Theory of Computation to design Compilers |
| CO5 | Design computations models for problems in Automata theory and adaptation of such modelin the field of compilers |
| COURSE CODE | 21CS52-COMPUTER NETWORKS |
| CO1 | Learn the basic needs of communication system |
| CO2 | Interpret the communication challenges and its solution. |
| CO3 | Identify and organize the communication system network components |
| CO4 | Design communication networks for user requirements |
| COURSE CODE | 21CS53-DATABASE MANAGEMENT SYSTEMS |
| CO1 | Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS |
| CO2 | Use Structured Query Language (SQL) for database manipulation and also demonstrate the basic of query evaluation |
| CO3 | Design and build simple database systems and *relate* the concept of transaction, concurrency control and recovery in database |
| CO4 | Develop application to interact with databases,  relational algebra expression |
| CO5 | Develop applications using tuple and domain relation expression from queries |

| COURSE CODE | 21CS54-ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING |
|---|---|
| CO1 | Apply the knowledge of searching and reasoning techniques for different applications |
| CO2 | Have a good understanding of machine leaning in relation to other fields and fundamentalissues and challenges of machine learning |
| CO3 | Apply the knowledge of classification algorithms on various dataset and compare results |
| CO4 | Model the neuron and Neural Network, and to analyze ANN learning and its applications |
| CO5 | Identifying the suitable clustering algorithm for different pattern |
| COURSE CODE | 21CSL55-DATABASE MANAGEMENT SYSTEM LABORATORY WITH MINI PROJECT |
| CO1 | Create, Update and query on the database |
| CO2 | Demonstrate the working of different concepts of DBMS |
| CO3 | Implement, analyze and evaluate the project developed for an application. |
| COURSE CODE | 21CSL581-ANGULAR JS AND NODE JS |
| CO1 | Describe the features of Angular JS |
| CO2 | Recognize the form validations and controls |
| CO3 | Implement Directives and Controllers |
| CO4 | Evaluate and create database for simple application |
| CO5 | Plan and build webservers with node using Node .JS |
| COURSE CODE | 21CS582-C# AND .NET FRAMEWORK |
| CO1 | Able to explain how C# fits into the .NET platform |
| CO2 | Describe the utilization of variables and constants of C# |
| CO3 | Use the implementation of object-oriented aspects in applications |
| CO4 | Analyze and Set up Environment of .NET Core |
| CO5 | Evaluate and create a simple project application |
| COURSE CODE | 21CS61-SOFTWARE ENGINEERING & PROJECT MANAGEMENT |
| CO1 | Understand the activities involved in software engineering and analyze the role of variousprocess models |
| CO2 | Explain the basics of object-oriented concepts and build a suitable class model using modellingtechniques |
| CO3 | Describe various software testing methods and to understand the importance of agile methodology and DevOps |
| CO4 | Illustrate the role of project planning and quality management in software developmentCO 5. Understand the importance of activity planning and different planning models |
| COURSE CODE | 21CS62-FULLSTACK DEVELOPMENT |
| CO1 | Understand the working of MVT based full stack web development with Django |
| CO2 | Designing of Models and Forms for rapid development of web pages |
| CO3 | Analyze the role of Template Inheritance and Generic views for developing full stack webapplications |
| CO4 | Apply the Django framework libraries to render nonHTML contents like CSV and PDF |
| CO5 | Perform jQuery based AJAX integration to Django Apps to build responsive full stack webapplications |

| COURSE CODE | 21CS63-COMPUTER GRAPHICS AND FUNDAMENTALS OF IMAGEPROCESSING |
|---|---|
| CO1 | Construct geometric objects using Computer Graphics principles and OpenGL APIs |
| CO2 | Use OpenGL APIs and related mathematics for 2D and 3D geometric Operations on the objects |
| CO3 | Design GUI with necessary techniques required to animate the created objects |
| CO4 | Apply OpenCV for developing Image processing applications |
| CO5 | Apply Image segmentation techniques along with programming, using OpenCV, for developingsimple applications |
| COURSE CODE | 21CS641-AGILE TECHNOLOGIES |
| CO1 | Understand the fundamentals of agile technologies |
| CO2 | Explain XP Lifecycle, XP Concepts and Adopting XP |
| CO3 | Apply different techniques on Practicing XP, Collaborating and Releasing |
| CO4 | Analyze the Values and Principles of Mastering Agility |
| CO5 | Demonstrate the agility to deliver good values |
| COURSE CODE | 21CS642-ADVANCED JAVA PROGRAMMING |
| CO1 | Understanding the fundamental concepts of Enumerations and Annotations |
| CO2 | Apply the concepts of Generic classes in Java programs |
| CO3 | Demonstrate the concepts of String operations in Java |
| CO4 | Develop web based applications using Java servlets and JSP |
| CO5 | Illustrate database interaction and transaction processing in Java |
| COURSE CODE | 21CS643-ADVANCED COMPUTER ARCHITECTURE |
| CO1 | Explain the concepts of parallel computing |
| CO2 | Explain and identify the hardware technologies |
| CO3 | Compare and contrast the parallel architectures |
| CO4 | Illustrate parallel programming concepts |
| COURSE CODE | 21CS644-DATA SCIENCE AND VISUALIZATION |
| CO1 | Understand the data in different forms |
| CO2 | Apply different techniques to Explore Data Analysis and the Data Science Process |
| CO3 | Analyze feature selection algorithms & design a recommender system |
| CO4 | Evaluate data visualization tools and libraries and plot graphs |
| CO5 | Develop different charts and include mathematical expressions |
| COURSE CODE | 21CS651-INTRODUCTION TO DATA STRUCTURES |
| CO1 | Express the fundamentals of static and dynamic data structure |
| CO2 | Summarize the various types of data structure with their operations |
| CO3 | Interpret various searching and sorting techniques |
| CO4 | Choose appropriate data structure in problem solving |
| CO5 | Develop all data structures in a high level language for problem solving |
| COURSE CODE | 21CS652-INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS |
| CO1 | Identify, analyze and define database objects, enforce integrity constraints on a database usingRDBMS |
| CO2 | Use Structured Query Language (SQL) for database manipulation |
| CO3 | Design and build simple database systems |
| CO4 | Develop application to interact with databases |
| COURSE CODE | 21CS653- INTRODUCTION TO CYBER SECURITY |
| CO1 | Describe the cyber crime terminologies |
| CO2 | Analyze cybercrime in mobiles and wireless devices along with the tools for Cybercrime andprevention |
| CO3 | Analyze the motive and causes for cybercrime, cybercriminals, and investigators |
| CO4 | Apply the methods for understanding criminal case and evidence, detection standing criminalcase and evidence |

| COURSE CODE | 21CS654-PROGRAMMING IN JAVA |
|---|---|
| CO1 | Develop JAVA programs using OOP principles and proper program structuring |
| CO2 | Develop JAVA program using packages, inheritance and interface |
| CO3 | Develop JAVA programs to implement error handling techniques using exception handling |
| CO4 | Demonstrate string handling concepts using JAVA |
| COURSE CODE | 21CSL66-COMPUTER GRAPHICS AND IMAGE PROCESSING LABORATORY |
| CO1 | Use openGL /OpenCV for the development of mini Projects |
| CO2 | Analyze the necessity mathematics and design required to demonstrate basic geometrictransformation techniques |
| CO3 | Demonstrate the ability to design and develop input interactive techniques |
| CO4 | Apply the concepts to Develop user friendly applications using Graphics and IP concepts |
| COURSE CODE | 21CS71-BIG DATA ANALYTICS |
| CO1 | Understand fundamentals and applications of Big Data analytics. |
| CO2 | Investigate Hadoop framework, Hadoop Distributed File system and essential Hadoop tools |
| CO3 | Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data. |
| CO4 | Demonstrate the MapReduce programming model to process the big data along with Hadoop tools |
| CO5 | Apply Machine Learning algorithms for real world big data, web contents and Social Networks to provide analytics with relevant visualization tools. |
| COURSE CODE | 21CS72-CLOUD COMPUTING |
| CO1 | Understand and analyze various cloud computing platforms and service provider. |
| CO2 | Illustrate various virtualization concepts. |
| CO3 | Identify the architecture, infrastructure and delivery models of cloud computing. |
| CO4 | Understand the Security aspects of CLOUD. |
| CO5 | Define platforms for development of cloud applications |
| COURSE CODE | 21CS731-OBJECT ORIENTED MODELING AND DESIGN |
| CO1 | Describe the concepts of object-oriented and basic class modelling. |
| CO2 | Draw class diagrams, sequence diagrams and interaction diagrams to solve problems. |
| CO3 | Choose and apply a befitting design pattern for the given problem. |
| COURSE CODE | 21CS732-DIGITAL IMAGE PROCESSING |
| CO1 | Understand the fundamentals of Digital Image Processing |
| CO2 | Apply different Image transformation techniques |
| CO3 | Analyze various image restoration techniques |
| CO4 | Understand colour image and morphological processing |
| CO5 | Design image analysis and segmentation techniques |
| COURSE CODE | 21CS733-CRYPTOGRAPHY AND NETWORK SECURITY |
| CO1 | Understand Cryptography, Network Security theories, algorithms and systems |
| CO2 | Apply different Cryptography and Network Security operations on different applications |
| CO3 | Analyze different methods for authentication and access control |
| CO4 | Evaluate Public and Private key, Key management, distribution and certification |
| CO5 | Design necessary techniques to build protection mechanisms to secure computer networks |
| COURSE CODE | 21CS734-BLOCKCHAIN TECHNOLOGY |
| CO1 | Describe the concepts of Distrbuted computing and its role in Blockchain |
| CO2 | Describe the concepts of Cryptography and its role in Blockchain |
| CO3 | List the benefits, drawbacks and applications of Blockchain |
| CO4 | Appreciate the technologies involved in Bitcoin |
| CO5 | Appreciate and demonstrate the Ethereum platform to develop blockchain application |

| COURSE CODE | 21CS735-INTERNET OF THINGS |
|---|---|
| CO1 | Understand the evolution of IoT, IoT networking components, and addressing strategies in IoT |
| CO2 | Analyze various sensing devices and actuator types |
| CO3 | Demonstrate the processing in IoT. |
| CO4 | Apply different connectivity technologies. |
| CO5 | Understand the communication technologies, protocols and interoperability in IoT. |
| COURSE CODE | 21CS741-SOFTWARE ARCHITECTURE AND DESIGN PATTERNS |
| CO1 | Design and implement codes with higher performance and lower complexity |
| CO2 | Be aware of code qualities needed to keep code flexible |
| CO3 | Experience core design principles and be able to assess the quality of a design with respect to these principles. |
| CO4 | Capable of applying these principles in the design of object oriented systems. |
| CO5 | Demonstrate an understanding of a range of design patterns. Be capable of comprehending a design presented using this vocabulary. |
| CO6 | Be able to select and apply suitable patterns in specific contexts |
| COURSE CODE | 21CS742-MULTIAGENT SYSTEMS |
| CO1 | Demonstrate the decision process with different constraints |
| CO2 | Analyze games in different forms |
| CO3 | Apply the cooperative learning in developing games |
| CO4 | Analyze different negotiation strategies of Multi-Agent System |
| CO5 | Design and develop solutions for voting problems |
| COURSE CODE | 21CS743-DEEP LEARNING |
| CO1 | Understand the fundamental issues and challenges of deep learning data, model selection, model complexity etc., |
| CO2 | Describe various knowledge on deep learning and algorithms |
| CO3 | Apply CNN and RNN model for real time applications |
| CO4 | Identify various challenges involved in designing and implementing deep learning algorithms |
| CO5 | Relate the deep learning algorithms for the given types of learning tasks in varied domain |
| COURSE CODE | 21CS744-ROBOTIC PROCESS AUTOMATION DESIGN AND DEVELOPMENT |
| CO1 | To Understand the basic concepts of RPA |
| CO2 | To Describe various components and platforms of RPA |
| CO3 | To Describe the different types of variables, control flow and data manipulation techniques |
| CO4 | To Understand various control techniques and OCR in RPA |
| CO5 | To Describe various types and strategies to handle exceptions |
| COURSE CODE | 21CS745-NOSQL DATABASE |
| CO1 | Demonstrate an understanding of the detailed architecture of Column Oriented NoSQL databases, Document databases, Graph databases. |
| CO2 | Use the concepts pertaining to all the types of databases. |
| CO3 | Analyze the structural Models of NoSQL. |
| CO4 | Develop various applications using NoSQL databases. |
| COURSE CODE | 21CS751-PROGRAMMING IN PYTHON |
| CO1 | Understand Python syntax and semantics and be fluent in the use of Python flow control and functions. |
| CO2 | Demonstrate proficiency in handling Strings and File Systems. |
| CO3 | Represent compound data using Python lists, tuples, Strings, dictionaries |
| CO4 | . Read and write data from/to files in Python Programs |
| COURSE CODE | 21CS752-INTRODUCTION TO AI AND ML |
| CO1 | Design intelligent agents for solving simple gaming problems. |
| CO2 | . Have a good understanding of machine leaning in relation to other fields and fundamental issues and Challenges of machine learning |
| CO3 | Understand data and applying machine learning algorithms to predict the outputs |
| CO4 | Model the neuron and Neural Network, and to analyze ANN learning and its |

| | applications. |
|---|---|
| **COURSE CODE** | **21CS753-INTRODUCTION TO BIG DATA** |
| **CO1** | Master the concepts of HDFS and MapReduce framework. |
| **CO2** | Investigate Hadoop related tools for Big Data Analytics and perform basic |
| **CO3** | Infer the importance of core data mining techniques for data analytics |
| **CO4** | Use Machine Learning algorithms for real world big data. |
| **COURSE CODE** | **21CS754- INTRODUCTION TO DATA SCIENCE** |
| **CO1** | Describe the data science terminologies |
| **CO2** | Apply the Data Science process on real time scenario. |
| **CO3** | Analyze data visualization tools |
| **CO4** | Apply Data storage and processing with frameworks |

# PG-M.Tech (SCS)2020-Scheme COs

| DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING | |
|---|---|
| **COURSE CODE** | **20SCS11-MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE** |
| **CO1** | Understand the numerical methods to solve and find the roots of the equations.. |
| **CO2** | Apply the technique of singular value decomposition for data compression, least square approximation in solving inconsistent linear systems |
| **CO3** | Understand vector spaces and related topics arising in magnification and rotation of images |
| **CO4** | Utilize the statistical tools in multi variable distributions. |
| **C05** | Use probability formulations for new predictions with discrete and continuous RV's. |
| **COURSE CODE** | **20SCS12- ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING** |
| **CO1** | Define Artificial intelligence and identify problems for AI. Characterize the search techniques to solve problems and recognize the scope of classical search techniques |
| **CO2** | Define knowledge and its role in AI. Demonstrate the use of Logic in solving AI problems |
| **CO3** | Demonstrate handling of uncertain knowledge and reasoning in probability theory |
| **CO4** | Understanding of Learning methods |
| **COURSE CODE** | **20SCS13-ADVANCES IN DATA BASE MANAGEMENT SYSTEM** |
| **CO1** | Select the appropriate high-performance database like parallel and distributed database |
| **CO2** | Infer and represent the real-world data using object-oriented database |
| **CO3** | Interpret rule set in the database to implement data warehousing of mining |
| **CO4** | Discover and design database for recent applications database for better interoperability |
| **COURSE CODE** | **20SCS14-ADVANCED ALGORITHMS** |
| **CO1** | Design and apply iterative and recursive algorithms |
| **CO2** | Design and implement optimization algorithms in specific applications. |
| **CO3** | Design appropriate shared objects and concurrent objects for applications. |
| **COURSE CODE** | **20SCS15-INTERNET OF THINGS AND APPLICATIONS** |
| **CO1** | Develop schemes for the applications of IOT in real time scenarios |
| **CO2** | Manage the Internet resources |
| **CO3** | Model the Internet of things to business |
| **CO4** | Understand the practical knowledge through different case studies |
| **CO5** | Understand data sets received through IoT devices and tools used for analysis |

| COURSE CODE | 20SCSL16-ALGORITHMS AND DATABASE MANAGEMENT SYSTEMS LABORATORY |
| --- | --- |
| CO1 | Work on the concepts of Software Testing and ADBMS at the practical level |
| CO2 | Compare and pick out the right type of software testing process for any given real-world problem |
| CO3 | Carry out the software testing process in efficient way |
| CO4 | Establish a quality environment as specified in standards for developing quality software |
| CO5 | Model and represent the real-world data using object-oriented database |
| CO6 | Embed the rules set in the database to implement various features of ADBMS |
| CO7 | Choose, design and implement recent applications database for better interoperability |
| COURSE CODE | 20RMI17-RESEARCH METHODOLOGY AND IPR |
| CO1 | Discuss research methodology and the technique of defining a research problem |
| CO2 | Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review |
| CO3 | Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections |
| CO4 | Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports |
| CO5 | Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR. |
| COURSE CODE | 20SCS21-DATA SCIENCE |
| CO1 | Define data science and its fundamentals |
| CO2 | Demonstrate the process in data science |
| CO3 | Explain machine learning algorithms necessary for data sciences |
| CO4 | Illustrate the process of feature selection and analysis of data analysis algorithms |
| CO5 | Visualize the data and follow of ethics |
| COURSE CODE | 20SCS22-SEMANTIC WEB AND SOCIAL NETWORKS |
| CO1 | Demonstrate the semantic web technologies like RDF Ontology and others |
| CO2 | Learn the various semantic web applications |
| CO3 | Identify the architectures and challenges in building social networks |
| CO4 | Analyse the performance of social networks using electronic sources |
| COURSE CODE | 20SCS23-BLOCKCHAIN TECHNOLOGY |
| CO1 | Understand the types, benefits and limitation of blockchain |
| CO2 | Explore the blockchain decentralization and cryptography concepts |
| CO3 | Enumerate the Bitcoin features and its alternative options. |
| CO4 | Describe and deploy the smart contracts |
| CO5 | Summarize the blockchain features outside of currencies. |

| COURSE CODE | 20SCS241-ADVANCED CRYPTOGRAPHY |
|---|---|
| CO1 | Understand OSI security architecture and classical 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 | Compare various Cryptographic Techniques |
| CO6 | Design Secure applications |
| CO7 | Inject secure coding in the developed applications |
| COURSE CODE | 20SCS242-NATURAL LANGUAGE PROCESSING |
| CO1 | Analyse the natural language text |
| CO2 | Generate the natural language. |
| CO3 | Demonstrate Text mining. |
| CO4 | Apply information retrieval techniques. |
| COURSE CODE | 20SCS24-CLOUD COMPUTING |
| CO1 | Compare the strengths and limitations of cloud computing |
| CO2 | Identify the architecture, infrastructure and delivery models of cloud computing |
| CO3 | Apply suitable virtualization concept. |
| CO4 | Choose the appropriate cloud player |
| CO5 | Address the core issues of cloud computing such as security, privacy and interoperability |
| CO6 | Design Cloud Services |
| CO7 | Set a private cloud |
| COURSE CODE | 20SCS244-PATTERN RECOGNITION |
| CO1 | Explain pattern recognition principals |
| CO2 | Develop algorithms for Pattern Recognition |
| CO3 | Develop and analyse decision tress |
| CO4 | Design the nearest neighbour classifier |
| CO5 | Apply Decision tree and clustering techniques to various applications |
| COURSE CODE | 20SCS251-IMAGE PROCESSING AND MACHINE VISION |
| CO1 | Explain the fundamentals of image processing and computer vision |
| CO2 | Illustrate the image enhancement techniques |
| CO3 | Illustrate Image restoration and image compression technique |
| CO4 | Tell about image segmentation and morphological image processing |
| CO5 | Summarize computer vision techniques and its uses |

| COURSE CODE | 20SCS252-OBJECT ORIENTED DESIGN |
|---|---|
| CO1 | Identify the heuristics of the object-oriented programming |
| CO2 | Explain the fundamentals of OOP |
| CO3 | Examine fine object-oriented relations |
| CO4 | Explain the role of Physical Object-Oriented Design |
| CO5 | Make use of Heuristics in The Use of Heuristics in Object-Oriented Design |
| COURSE CODE | 20SCS253-SOFTWARE DEFINED NETWORKS |
| CO1 | Explain the fundamentals of SDN and make use of open flow tool |
| CO2 | Illustrate the concepts of controllers and network programmability |
| CO3 | Explain data centre and NFV |
| CO4 | Build an SDN framework |
| CO5 | Report use case |
| COURSE CODE | 20SCS254-MODERN COMPUTER ARCHITECTURE |
| CO1 | Explain the fundamentals of Fundamentals of Computer Design, Pipelining, ILP |
| CO2 | Summarize the concept of memory |
| CO3 | Abstracting the concept of parallelism |
| CO4 | Summarize the hardware technologies |
| CO5 | Outlineparallel and scalable architectures |
| COURSE CODE | 20SCSL26-DATA SCIENCE LABORATORY |
| CO1 | Demonstration of data visualization methods |
| CO2 | Understanding and implementation of data science algorithms |
| COURSE CODE | 20SCS27-TECHNICAL SEMINAR |
| CO1 | Choose, preferably through peer reviewed journals, a recent topic of his/her interest relevant to the Course of Specialization |
| CO2 | Carryout literature survey, organize the Course topics in a systematic order. |
| CO3 | Prepare the report with own sentences. |
| CO4 | Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities |
| CO5 | Present the seminar topic orally and/or through power point slides. |
| CO6 | Answer the queries and involve in debate/discussion. |
| CO7 | Submit two copies of the typed report with a list of references |

| COURSE CODE | 20SCS31-DEEP LEARNING |
|---|---|
| CO1 | Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains. |
| CO2 | Implement deep learning algorithms and solve real-world problems. |
| CO3 | Execute performance metrics of Deep Learning Techniques. |
| | 20SCS321-ENGINEERING ECONOMICS |
| CO1 | Describe the principles of economics that govern the operation of any organization under diverse market conditions |
| CO2 | Comprehend macroeconomic principles and decision making in diverse business set up |
| CO3 | Explain the Inflation & Price Change as well as Present Worth Analysis |
| CO4 | Apply the principles of economics through various case studies |
| COURSE CODE | 20SCS322-VIRTUAL REALITY |
| CO1 | Explain fundamentals of virtual reality systems |
| CO2 | Summarize the hardware and software of the VR |
| CO3 | Analyse the applications of VR |
| COURSE CODE | 20SCS322-SOFT AND EVOLUTIONARY COMPUTING |
| CO1 | Implement machine learning through neural networks |
| CO2 | Design Genetic Algorithm to solve the optimization problem. |
| CO3 | Develop a Fuzzy expert system. |
| CO4 | Model Neuro Fuzzy system for clustering and classification |
| COURSE CODE | 20SCS324-MULTICORE ARCHITECTURE AND PROGRAMMING |
| CO1 | Identify the limitations of single core architecture and the need for multicore architectures |
| CO2 | Define fundamental concepts of parallel programming and its design issues |
| CO3 | Solve the issues related to multiprocessing and suggest solutions |
| CO4 | Demonstrate the role of OpenMP and programming concept |
| CO5 | Make out the salient features of different multicore architectures and how they exploit parallelism |
| COURSE CODE | 20SCS331-BUSINESS INTELLIGENCE AND ITS APPLICATIONS |
| CO1 | Explain the complete life cycle of BI/Analytical development |
| CO2 | Illustrate technology and processes associated with Business Intelligence framework |
| CO3 | Demonstrate a business scenario, identify the metrics, indicators and make recommendations to achieve the business goal. |
| COURSE CODE | 20SCS332-ROBOTICS AND AUTOMATION |
| CO1 | Classify various types of automation & manufacturing systems |
| CO2 | Discuss different robot configurations, motions, drive systems and its performance parameters |
| CO3 | Describe the basic concepts of control systems, feedback components, actuators and power transmission systems used in robots. |

| CO4 | Explain the working of transducers, sensors and machine vision systems |
| --- | --- |
| CO5 | Discuss the future capabilities of sensors, mobility systems and Artificial Intelligence in the field of robotics |
| **COURSE CODE** | **20SCS333-SPEECH PROCESSING** |
| CO1 | Explain the fundamentals of speech processing |
| CO2 | Summarize the models of speech processing |
| CO3 | Infer the linear predictive coding |
| CO4 | Illustrate the application of speech processing |
| **COURSE CODE** | **20SCS334-WIRELESS SENSOR NETWORKS** |
| CO1 | Know the basics , characteristics and challenges of Wireless Sensor Network |
| CO2 | Apply the knowledge to identify appropriate physical and MAC layer protocol |
| CO3 | Apply the knowledge to identify the suitable routing algorithm based on the network and user requirement |
| CO4 | Be familiar with the OS used in Wireless Sensor Networks and build basic modules |
| CO5 | Understand the applications of WSN in various fields |
| **COURSE CODE** | **20SCS34-PROJECT WORK PHASE – 1** |
| CO1 | Demonstrate a sound technical knowledge of their selected project topic |
| CO2 | Undertake problem identification, formulation, and solution |
| CO3 | Design engineering solutions to complex problems utilising a systems approach |
| CO4 | Communicate with engineers and the community at large in written an oral forms |
| CO5 | Demonstrate the knowledge, skills and attitudes of a professional engineer |
| **COURSE CODE** | **20SCS35-MINI PROJECT** |
| CO1 | Present the mini-project and be able to defend it |
| CO2 | Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task. |
| CO3 | Habituated to critical thinking and use problem solving skills. |
| CO4 | Communicate effectively and to present ideas clearly and coherently in both the written and oral forms. |
| CO5 | Work in a team to achieve common goal. |
| CO6 | Learn on their own, reflect on their learning and take appropriate actions to improve it. |
| **COURSE CODE** | **20SCSI36-INTERNSHIP / PROFESSIONAL PRACTICE** |
| CO1 | Gain practical experience within industry in which the internship is done |
| CO2 | Acquire knowledge of the industry in which the internship is done. |
| CO3 | Apply knowledge and skills learned to classroom wor |
| CO4 | Develop a greater understanding about career options while more clearly defining personal career goals |
| CO5 | Experience the activities and functions of professionals. |
| CO6 | Develop and refine oral and written communication skills |

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| **CO7** | Identify areas for future knowledge and skill development. |
| **CO8** | Expand intellectual capacity, credibility, judgment, intuition |
| **CO9** | Acquire the knowledge of administration, marketing, finance and economics. |
| **COURSE CODE** | **20SCS41-PROJECT WORK PHASE -2** |
| **CO1** | Present the project and be able to defend it |
| **CO2** | Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task. |
| **CO3** | Habituated to critical thinking and use problem solving skills |
| **CO4** | Communicate effectively and to present ideas clearly and coherently in both the written and oral forms |
| **CO5** | Work in a team to achieve common goal. |
| **CO6** | Learn on their own, reflect on their learning and take appropriate actions to improve it. |

# PROGRAMME OUTCOME, PROGRAMMESPECIFIC OUTCOMES AND COURSEOUTCOMES OF ALL DEPARTMENTS–2023-24(CRITERIA- 2)

## Department of Electronics & Communication Engineering

**Program Outcomes (PO's)**

**PO 1: Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO 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.

**PO 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.

**PO 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.

**PO 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.

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

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

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

**PO 9: Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

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

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

**Program Specific Outcomes (PSO's)**

**PSO 1:** Analyse and Design Electronic Systems for Signal Processing and Communication Applications.

**PSO 2:** Demonstrate the Conceptual Domain Knowledge With Respect to Architecture, Design, Analysis and Engineering deployment in Data Communication and Computer Networking. Embedded system. Microcontroller, Advanced communication system.

**PSO 3:** Identify and Apply Domain Specific Tools For Design, Analysis, Synthesis and Validation Of VLSI, Optical Fiber Communication and Communication Systems.

| ELECTRONICS AND COMMUNICATION ENGINEERING 2022 Scheme | |
|---|---|
| **Course Code** | **22BBEE103/203- Basic Electronics** |
| CO1 | Develop the basic knowledge on construction, operation and characteristics of semiconductor devices |
| CO2 | Apply the acquired knowledge to construct small scale circuits consisting of semiconductor devices |
| CO3 | Develop competence knowledge to constructbasic digital circuitby make use of basic gate and its function |
| CO4 | Construct the conceptual blocks for basic communication system |
| CO5 | Apply the knowledge of various transducers principle in sensor system |
| **Course Code** | **22BMATEC301 - AV Mathematics-III for EC Engineering** |
| CO1 | Demonstrate the Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing, and field theory |
| CO2 | To use Fourier transforms to analyze problems involving continuous-time signals |
| CO3 | To apply Z-Transform techniques to solve difference equations |
| CO4 | Understand that physical systems can be described by differential equations and solve such equations |
| CO5 | Make use of correlation and regression analysis to fit a suitable mathematical model for statistical data |
| **Course Code** | **22BEC302 - Digital System Design using Verilog** |
| CO1 | Simplify Boolean functions using K-map and Quine-McCluskey minimization technique |
| CO2 | Analyze and design for combinational logic circuits. |
| CO3 | Analyze the concepts of Flip Flops(SR, D,T and JK) and to design the synchronous sequential circuits using Flip Flops |
| CO4 | Model Combinational circuits (adders, subtractors, multiplexers) and sequential circuits using Verilog descriptions. |
| **Course Code** | **22BEC303 - Electronic Principles and Circuits** |
| CO1 | Understand the characteristics of BJTs and FETs for switching and amplifier circuits |
| CO2 | Design and analyze amplifiers and oscillators with different circuit configurations and biasingconditions |
| CO3 | Understand the feedback topologies and approximations in the design of amplifiers and oscillators |
| CO4 | Design of circuits using linear ICs for wide range applications such as ADC, DAC, filters and timers. |
| CO5 | Understand the power electronic device components and its functions for basic power electronic circuits |
| **Course Code** | **22BEC304 - Network Analysis** |
| CO1 | Determine currents and voltages using source transformation/ source shifting/ mesh/nodal analysis and reduce given network using star delta transformation |
| CO2 | Solve problems by applying Network Theorems and electrical laws to reduce circuit complexities and to arrive at feasible solutions. |
| CO3 | Analyse the circuit parameters during switching transients and apply Laplace transform to solve the given network |

| CO4 | Evaluate the frequency response for resonant circuits and the network parameters for two port networks |
|---|---|
| **Course Code** | **22BECL305 - Analog and Digital Systems Design Laboratory** |
| CO1 | Design and analyze the BJT/FET amplifier and oscillator circuits |
| CO2 | Design and test Opamp circuits to realize the mathematical computations, DAC and precision rectifiers |
| CO3 | Design and test the combinational logic circuits for the given specifications |
| CO4 | Test the sequential logic circuits for the given functionality |
| CO5 | Demonstrate the basic circuit experiments using 555 timer |
| **Course Code** | **22BEC306C - Computer Organization and Architecture** |
| CO1 | Explain the basic organization of a computer system |
| CO2 | Describe the addressing modes, instruction formats and program control statement |
| CO3 | Explain different ways of accessing an input/ output device including interrupts |
| CO4 | Illustrate the organization of different types of semiconductor and other secondary storage memories |
| CO5 | Illustrate simple processor organization based on hard wired control and microprogrammed control. |
| **Course Code** | **22BEC358C - C++ Basics** |
| CO1 | Write C++ program to solve simple and complex problems |
| CO2 | Apply and implement major object-oriented concepts like message passing, function overloading, operator overloading and inheritance to solve real-world problems. |
| CO3 | Use major C++ features such as Templates for data type independent designs and File I/O to deal with large data set |
| CO4 | Analyze, design and develop solutions to real-world problems applying OOP concepts of C++ |
| **Course Code** | **22BEC401 - Engineering Electromagnetics** |
| CO1 | Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume. |
| CO2 | Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem. |
| CO3 | Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations |
| CO4 | Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits. |
| CO5 | Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem |
| **Course Code** | **22BEC402 - Basic Signal Processing** |
| CO1 | Understand the basics of Linear Algebra |
| CO2 | Analyze different types of signals and systems |
| CO3 | Analyze the properties of discrete-time signals & systems |
| CO4 | Analyze discrete time signals & systems using Z transforms |
| **Course Code** | **22BEC403- PRINCIPLES OF COMMUNICATION SYSTEMS** |
| CO1 | Understand the amplitude and frequency modulation techniques and perform time and frequency domain transformations |
| CO2 | Identify the schemes for amplitude and frequency modulation and demodulation of analog signals |

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| | and compare the performance |
| CO3 | Characterize the influence of channel noise on analog modulated signals. |
| CO4 | Define the schemes for sampling, pulse amplitude modulation and pulse code modulation systems |
| CO5 | Design of circuits used in different stages of communication transmitters and receivers |
| **Course Code** | **22BECL404 - Communication Laboratory** |
| CO1 | Understand the basic concepts of RF transmitters and Receivers |
| CO2 | Illustrate the AM and FM modulation generation and detection using suitable electronic circuits |
| CO3 | Design and test the sampling, Multiplexing and pulse modulation techniques using electronic hardware |
| CO4 | Design and Demonstrate the electronic circuits used for RF transmitters and receivers |
| **Course Code** | **22BEC405A - 8051 MICROCONTROLLER** |
| CO1 | Explain the difference between Microprocessors & Microcontrollers, Architectureof 8051 Microcontroller, Interfacing of 8051 to external memory and Instruction set of 8051. |
| CO2 | Write 8051 Assembly level programs using 8051 instruction set |
| CO3 | Explain the Interrupt system, operation of Timers/Counters and Serial port of 8051. |
| CO4 | Write 8051 Assembly language program to generate timings and waveformsusing 8051 timers, to send & receive serial data using 8051 serial port and to generate an external interrupt using a switch |
| CO5 | Write 8051 C programs to generate square wave on 8051 I/O port pin using interrupt and to send & receive serial data using 8051 serial port. Interface simpleswitches, simple LEDs, ADC 0804, LCD and Stepper Motorto 8051 using 8051 I/O ports |
| **Course Code** | **22BEC456A - Embedded C Basics** |
| CO1 | Write C programs in 8051for solving simple problems that manipulate input data using different instructions. |
| CO2 | Develop testing and experimental procedures on 8051Microcontroller, analyze their operation under different cases. |
| CO3 | Develop programs for 8051Microcontroller to implement real world problems |
| CO4 | Develop microcontroller applications using external hardware interface |

| ELECTRONICS AND COMMUNICATION ENGINEERING<br>2021-Scheme | |
|---|---|
| **Course Code** | **21ELN14/24 - BASIC ELECTRONICS & COMMUNICATION ENGINEERING** |
| CO1 | Describe the concepts of electronic circuits encompassing power supplies, amplifiers and oscillators |
| CO2 | Present the basics of digital logic engineering including data representation, circuits and the microcontroller system with associated sensors and actuators. |
| CO3 | Discuss the characteristics and technological advances of embedded systems. |
| CO4 | Relate to the fundamentals of communication engineering spanning from the frequency spectrum to the various circuits involved including antennas. |
| CO5 | Explain the different modes of communications from wired to wireless and the computing involved |
| **Course Code** | **21MAT 31 - TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICALTECHNIQUES** |
| CO1 | To solve ordinary differential equations using Laplace transform |
| CO2 | Demonstrate the Fourier series to study the behaviour of periodic functions and their applicationsin system communications, digital signal processing and field theory |
| CO3 | To use Fourier transforms to analyze problems involving continuous-time signals and to apply<br>ZTransform techniques to solve difference equations |
| CO4 | To solve mathematical models represented by initial or boundary value problems involving partial<br>differential equations |
| CO5 | Determine the extremals of functionals using calculus of variations and solve problems arising in<br>dynamics of rigid bodies and vibrational analysis. |
| **Course Code** | **21EC32 - Digital System Design Using Verilog** |
| CO1 | Simplify Boolean functions using K-map and Quine-McCluskey minimization technique |
| CO2 | Analyze and design for combinational logic circuits |
| CO3 | Analyze the concepts of Flip Flops (SR, D, T and JK) and to design the synchronous sequentialcircuits using Flip Flops. |
| CO4 | Model Combinational circuits (adders, subtractors, multiplexers) and sequential circuits using<br>Verilog descriptions. |
| **Course Code** | **21EC33 - Basic Signal Processing** |
| CO1 | Understand the basics of Linear Algebra |
| CO2 | Analyse different types of signals and systems |
| CO3 | Analyse the properties of discrete time signals & systems |
| CO4 | Analyse discrete time signals & systems using Z transforms |
| **Course Code** | **21EC34 - Analog Electronic Circuits** |
| CO1 | Understand the characteristics of BJTs and FETs for switching and amplifier circuits. |
| CO2 | Design and analyze FET amplifiers and oscillators with different circuit configurations and<br>biasing conditions. |
| CO3 | Understand the feedback topologies and approximations in the design of amplifiers and oscillators |
| CO4 | Design of circuits using linear ICs for wide range applications such as ADC, DAC, filters and<br>timers |
| CO5 | Understand the power electronic device components and its functions for basic power electronic<br>circuits. |
| **Course Code** | **21ECL35 - Analog and Digital Electronics Lab** |
| CO1 | Design and analyze the BJT/FET amplifier and oscillator circuits |

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| CO2 | Design and test Opamp circuits to realize the mathematical computations, DAC and precision rectifiers. |
| CO3 | Design and test the combinational logic circuits for the given specifications |
| CO4 | Test the sequential logic circuits for the given functionality |
| CO5 | Demonstrate the basic electronic circuit experiments using SCR and 555 timer. |
| **Course Code** | **21EC382 - AEC (Analog Electronic Circuits) Lab** |
| CO1 | Understand the circuit schematic and its working |
| CO2 | Study the characteristics of different electronic devices |
| CO3 | Design and test simple electronic circuits as per the specifications using discrete electronic components. |
| CO4 | Compute the parameters from the characteristics of active devices. |
| CO5 | Familiarize with EDA software which can be used for electronic circuit simulation. |
| **Course Code** | **21EC41 - Maths for Communication Engineers** |
| CO1 | Recall the basic laws and definitions (with mathematical representations) in Electric and Magnetic fields. |
| CO2 | Apply the basic laws of Electric and Magnetic fields to arrive at Divergence Theorem, Current continuity Equation, Curl, Stokes' theorem |
| CO3 | Apply Electric and Magnetic field concepts to arrive at Maxwell's equations, Electromagnetic wave equations and Poynting's theorem (Important concepts related to Communication link). |
| CO4 | Recall the definitions related to Random variables and Random Processes |
| CO5 | Model the Random events in the Communication set-up and determine useful statistical parameters. |
| **Course Code** | **21EC42 - Digital Signal Processing** |
| CO1 | Determine response of LTI systems using time domain and DFT techniques |
| CO2 | Compute DFT of real and complex discrete time signals |
| CO3 | Compute DFT using FFT algorithms |
| CO4 | Design FIR and IIR Digital Filters |
| CO5 | Design of Digital Filters using DSP processor |
| **Course Code** | **21EC43- Circuits & Controls** |
| CO1 | Analyse and solve Electric circuit, by applying, loop analysis, Nodal analysis and by applying network Theorems. |
| CO2 | Evaluate two port parameters of a network and Apply Laplace transforms to solve electricnetworks |
| CO3 | Deduce transfer function of a given physical system, from differential equation representation or Block Diagram representation and SFG representation |
| CO4 | Calculate time response specifications and analyse the stability of the system |
| CO5 | Draw and analyse the effect of gain on system behaviour using root loci. |
| CO6 | Perform frequency response Analysis and find the stability of the system |
| CO7 | Represent State model of the system and find the time response of the system. |
| **Course Code** | **21EC44 - Communication Theory** |
| CO1 | Understand the amplitude and frequency modulation techniques and perform time and frequency domain transformations |
| CO2 | Identify the schemes for amplitude and frequency modulation and demodulation of analog signals and compare the performance |
| CO3 | Characterize the influence of channel noise on analog modulated signals |
| CO4 | Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems |

| CO5 | Illustration of digital formatting representations used for Multiplexers, Vocoders and Videotransmission. |
|---|---|
| **Course Code** | **21ECL46 - Communication Laboratory I** |
| CO1 | Demonstrate the AM and FM modulation and demodulation by representing the signals in time and frequency domain. |
| CO2 | Design and test the sampling, Multiplexing and PAM with relevant circuits |
| CO3 | Demonstrate the basic circuitry and operations used in AM and FM receivers |
| CO4 | Illustrate the operation of PCM and delta modulations for different input conditions |
| **Course Code** | **21EC482- C++ Basics** |
| CO1 | Write C++ program to solve simple and complex problems |
| CO2 | Apply and implement major object-oriented concepts like message passing, function overloading, operator overloading and inheritance to solve real-world problems |
| CO3 | Use major C++ features such as Templates for data type independent designs and File I/O to deal with large data set |
| CO4 | Analyze, design and develop solutions to real-world problems applying OOP concepts of C++ |
| **Course Code** | **21EC51 - Digital Communication** |
| CO1 | Analyze different digital modulation techniques and choose the appropriate modulation technique for the given specifications |
| CO2 | Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels |
| CO3 | Differentiate various spread spectrum schemes and compute the performance parameters of communication system. |
| CO4 | Apply the fundamentals of information theory and perform source coding for given message |
| CO5 | Apply different encoding and decoding techniques with error Detection and Correction |
| **Course Code** | **21EC52 - Computer Organization & ARM Microcontrollers** |
| CO1 | Explain the basic organization of a computer system |
| CO2 | Demonstrate functioning of different sub systems, such as processor, Input/output, and memory |
| CO3 | Describe the architectural features and instructions of 32-bit microcontroller ARM Cortex M3 |
| CO4 | Apply the knowledge gained for Programming ARM Cortex M3 for different applications. |
| **Course Code** | **21EC53 - Computer Communication Networks** |
| CO1 | Understand the concepts of networking thoroughly |
| CO2 | Identify the protocols and services of different layers |
| CO3 | Distinguish the basic network configurations and standards associated with each network. |
| CO4 | Discuss and analyse the various applications that can be implemented on networks |
| **Course Code** | **21EC54 - ELECTROMAGNETIC WAVES** |
| CO1 | Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume |
| CO2 | Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem |
| CO3 | Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations |
| CO4 | Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials |

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| | and voltage induced in electric circuits. |
| CO5 | Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and<br>Evaluate power associated with EM waves using Poynting theorem |
| **Course Code** | **21ECL55 - Communication Lab II** |
| CO1 | Design and test the digital modulation circuits and display the waveforms |
| CO2 | To Implement the source coding algorithm using C/C++/ MATLAB code |
| CO3 | To Implement the Error Control coding algorithms using C/C++/ MATLAB code. |
| CO4 | Illustrate the operations of networking concepts and protocols using C programming and network simulators. |
| **Course Code** | **21EC581 - IoT (Internet of Things) Lab** |
| CO1 | Understand internet of Things and its hardware and software components |
| CO2 | Interface I/O devices, sensors & communication modules |
| CO3 | Remotely monitor data and control devices |
| CO4 | Develop real life IoT based projects |
| **Course Code** | **21EC62 - Microwave Theory and Antennas** |
| CO1 | Describe the use and advantages of microwave transmission |
| CO2 | Analyze various parameters related to transmission lines. |
| CO3 | Identify microwave devices for several applications |
| CO4 | Analyze various antenna parameters and their significance in building the RF system |
| CO5 | Identify various antenna configurations for suitable applications |
| **Course Code** | **21EC63- VLSI Design and Testing** |
| CO1 | Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology<br>scaling |
| CO2 | Draw the basic gates using the stick and layout diagram with the knowledge of physical design<br>aspects |
| CO3 | Interpret memory elements along with timing considerations |
| CO4 | Interpret testing and testability issues in combinational logic design |
| CO5 | Interpret testing and testability issues in combinational logic design |
| **Course Code** | **21EC643 - Python Programming** |
| CO1 | To acquire programming skills in Python |
| CO2 | To demonstrate data structure representation using Python |
| CO3 | To develop the skill of pattern matching and files in Python |
| CO4 | To acquire Object Oriented Skills in Python |
| CO5 | To develop the ability to write database applications in Python |
| **Course Code** | **21EC653 - Basic VLSI Design** |
| CO1 | Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology<br>scaling |
| CO2 | Draw the basic gates using the stick and layout diagrams with the knowledge of physical design<br>aspects |
| CO3 | Interpret Memory elements along with timing considerations |
| CO4 | Demonstrate knowledge of FPGA based system design |
| CO5 | Interpret testing and testability issues in VLSI Design |
| CO6 | Analyze CMOS subsystems and architectural issues with the design constraints |
| **Course Code** | **21ECL66 - VLSI Laboratory** |
| CO1 | Design and simulate combinational and sequential digital circuits using Verilog HDL. |
| CO2 | Understand the synthesis process of digital circuits using EDA tool |
| CO3 | Perform ASIC design flow and understand the process of synthesis, synthesis constraints and<br>evaluating the synthesis reports to obtain optimum gate level netlist. |

| | |
|---|---|
| CO4 | Design and simulate basic CMOS circuits like inverter, common source amplifier, differential amplifier, SRAM |
| CO5 | Perform RTL_GDSII flow and understand the stages in ASIC design |
| **Course Code** | **21EC71 - Advanced VLSI** |
| CO1 | Understand VLSI design flow |
| CO2 | Describe the concepts of ASIC design methodology |
| CO3 | Create floor plan including partition and routing with the use of CAD algorithms |
| CO4 | Will have better insights into VLSI back-end design flow |
| CO5 | Learn verification basics and System Verilog |
| **Course Code** | **21EC72 - Optical & Wireless Communication** |
| CO1 | Classification and characterization of optical fibers with different modes of signal propagation |
| CO2 | Describe the constructional features and the characteristics of optical fiber and optical devices used for signal transmission and reception |
| CO3 | Understand the essential concepts and principles of mobile radio channel and cellular communication. |
| CO4 | Describe various multiple access techniques used in wireless communication systems |
| CO5 | Describe the GSM architecture and procedures to establish call set up, call progress handling and call tear down in a GSM cellular network. |
| **Course Code** | **21EC722 – Digital Image Processing** |
| CO1 | Understand image formation and the role of human visual system plays in perception of gray and color image data |
| CO2 | Compute various transforms on digital images |
| CO3 | Conduct independent study and analysis of Image Enhancement techniques |
| CO4 | Apply image processing techniques in frequency (Fourier) domain |
| CO5 | Design image restoration techniques |
| **Course Code** | **21EC732 – Network Security** |
| CO1 | Explain network security services and mechanisms and explain security concepts |
| CO2 | Understand the concept of Transport Level Security and Secure Socket Layer |
| CO3 | Explain Security concerns in Internet Protocol security |
| CO4 | Explain Intruders, Intrusion detection and Malicious Software |
| CO5 | Describe Firewalls, Firewall Characteristics, Biasing and Configuration |
| **Course Code** | **21CS744 - ROBOTIC PROCESS AUTOMATION DESIGN AND DEVELOPMENT** |
| CO1 | To Understand the basic concepts of RPA |
| CO2 | To Describe various components and platforms of RPA |
| CO3 | To Describe the different types of variables, control flow and data manipulation techniques |
| CO4 | To Understand various control techniques and OCR in RPA |
| CO5 | To Describe various types and strategies to handle exceptions |

# PROGRAMME OUTCOME, PROGRAMMESPECIFIC OUTCOMES AND COURSEOUTCOMES OF ALL DEPARTMENTS–2023-24(CRITERIA- 2)

## Department of Electrical & Electronics Engineering

**Program Outcomes (PO's)**

**PO 1: Engineering Knowledge:** Apply knowledge of differential equations, vector calculus, complex variables, matrix theory, probability theory, physics and chemistry, electrical and electronic engineering fundamentals.

**PO 2: Problem Analysis:** Graduates will Identify, formulate and solve complex electrical and electronics engineering problems using the first principles of mathematics natural sciences and engineering science

**PO 3: Design:** Graduates will design Electrical and Electronics systems meeting the given specifications for different problems taking safety and precautions into consideration.

**PO 4: Investigations:** Graduates will Perform investigations, design and conduct experiments, analyze and interpret the results to provide valid conclusions.

**PO 5: Tool Usage:** Graduates will use modern software tools to model and analyze problems, apply appropriate techniques and IT tools for the design & analysis of the systems keeping in view their limitations.

**PO 6: The Engineer and Society:** Graduates will understand the impact of local and global issues / happenings and assess societal, health, legal and cultural issues with competency in professional engineering practice on Electrical Engineers.

**PO 7: Environment and Sustainability:** Graduates will Demonstrate professional skills and contextual reasoning and provide sustainable solutions for problems related to Electrical and Electronics Engineering and also will understand their impact on environment.

**PO 8: Ethics:** Graduates will have knowledge of professional ethics and code of conduct as applied to Electrical Engineers.

**PO 9: Individual and Team work:** Graduates will work effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.

**PO 10: Communication:** Graduates will communicate effectively in both verbal and written form among engineering community, being able to comprehend and write reports, presentation and give / receive clear instructions.

**PO 11: Project Management and Finance:** Graduates will plan, demonstrate and execute engineering & management principles in their own / team projects in multidisciplinary environment

**PO 12: Life-long learning:** Graduates will have the ability for self- education ,recognize the need for and have the ability to engage in independent and lifelong learning.

**Program Specific Outcomes (PSO's)**

**PSO 1:** Ability to specify architect, design and analyze systems that efficiency generate, transmit, distribute and utilize electrical power.

**PSO 2:** Ability to specify design, prototype and test modern electronic systems that perform analog and digital processing function.

**PSO 3:** Ability to use software for design, simulation and analysis of electrical system.

# ELECTRICAL & ELECTRONICS ENGINEERING
## (2022 SCHEME COs)

| COURSE CODE | 22EEE13 BASIC ELECTRICAL ENGINEERING |
|---|---|
| CO1 | Understand the concepts of DC circuits and Electromagnetism. |
| CO2 | Understand the concepts of single phase and Three phase AC circuits. |
| CO3 | Apply the basic Electrical laws to solve circuits. |
| CO4 | Understand the concepts of measurements and measuring Instruments |
| CO5 | Explain the concepts of domestic wiring, electricity billing, circuit protective devices and personal safety measures. |

| COURSE CODE | 22EEE23 BASIC ELECTRICAL ENGINEERING |
|---|---|
| CO1 | Understand the concepts of DC circuits and Electromagnetism. |
| CO2 | Understand the concepts of single phase and Three phase AC circuits. |
| CO3 | Apply the basic Electrical laws to solve circuits. |
| CO4 | Understand the concepts of measurements and measuring Instruments |
| CO5 | Explain the concepts of domestic wiring, electricity billing, circuit protective devices and personal safety measures. |

| COURSE CODE | BMATE 301 Mathematics-III for EE Engineering |
|---|---|
| CO1 | Understand that physical systems can be described by differential equations and solve such equations |
| CO2 | Make use of correlation and regression analysis to fit a suitable mathematical model for statistical data |
| CO3 | Demonstrate the Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing, and field theory. |
| CO4 | To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations |

| COURSE CODE | 22EE302 Electric Circuit Analysis |
|---|---|
| CO1 | Understand that physical systems can be described by differential equations and solve such equations |
| CO2 | Make use of correlation and regression analysis to fit a suitable mathematical model for statistical data |
| CO3 | Demonstrate the Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing, and field theory. |
| CO4 | To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations |
| CO5 | Apply discrete and continuous probability distributions in analyzing the probability models arising in the engineering field. Demonstrate the validity of testing the hypothesis. |

| COURSE CODE | BEE303 Analog Electronic Circuits |
|---|---|
| CO1 | Utilize the characteristics of transistor for different applications. |
| CO2 | Design and analyze biasing circuits for transistor. |
| CO3 | Design, analyze and test transistor circuitry as amplifiers and oscillators |

| COURSE CODE | BEE304 Transformers and Generators |
|---|---|
| CO1 | Explain the construction, working and various tests of single phase Transformer. |

| CO2 | Explain the construction, working and parallel operation of three phase Transformer. |
|---|---|
| CO3 | Explain the construction, working and analysis of Synchronous Generator. |
| CO4 | Explain the construction, working of solar and wind power generators. |
| **COURSE CODE** | **BEEL305 Transformers and Generators Lab** |
| CO1 | Conduct various tests on transformers and synchronous machines and evaluate their performance. |
| CO2 | Perform the parallel operation on two single phase transformers. |
| CO3 | Verify the performance of synchronous generator. |
| CO4 | Calculate the voltage regulation of an alternator using different methods for comparison. |
| **COURSE CODE** | **BEE 306A  DIGITAL LOGIC CIRCUITS** |
| CO1 | Explain the concept of combinational and sequential logic circuits |
| CO2 | Analyse and design combinational circuits |
| CO3 | Describe and characterize flip flops and its applications |
| CO4 | Design the sequential circuits using SR, JK, D and T flip-flops and Melay and Moore applications |
| CO5 | Design applications of combinational and sequential circuits |
| CO6 | Employ the digital circuits for different applications |
| **COURSE CODE** | **BEE306B Electrical Measurements and Instrumentation** |
| CO1 | Explain the significance and methods of Measurements, elements of generalised measurement system and errors in measurements. |
| CO2 | Measure resistance, inductance and capacitance by different methods. |
| CO3 | Explain the construction, working and characteristics of various instrument transformers. |
| CO4 | Explain the working of different electronic instruments and display devices. |
| **COURSE CODE** | **BEE 306C  ELECTROMAGNETIC FIELD THEORY** |
| CO1 | Explain Scalars, Vectors, Cartesian co-ordinate system, relation between different coordinate systems, Coulomb's law, Electric field intensity and its evaluation for different charge conditions. |
| CO2 | Explain the potential field of a point charge, Potential gradient, Energy density in the electrostatic field and conductor's properties and boundary conditions. |
| CO3 | Explain the Poisson's and Laplace Equations, Biot - Savart's law, Ampere's circuital law and Stokes theorem. |
| CO4 | Explain the Magnetic force, Force between differential current elements. Force and torque on a closed circuit, Nature of magnetic materials and Magnetic boundary conditions |
| CO5 | Explain the Faraday's law, Displacement current. Maxwell's equations, Wave propagation in free space and indielectrics. |
| **COURSE CODE** | **BEEL358A Scilab / MATLAB for Transformers & Generators** |
| CO1 | Analyse in an intelligent manner, think better, and perform better. |
| **COURSE CODE** | **BEEL358B 555 IC Laboratory** |
| CO1 | Analyse in an intelligent manner, think better, and perform better. |
| **COURSE CODE** | **BEEL358C Circuit Laboratory using P-spice** |
| CO1 | Analyse in an intelligent manner, think better, and perform better. |

| COURSE CODE | BEEL358D ELECTRICAL HARDWARE LABORATORY |
|---|---|
| CO1` | Analyse in an intelligent manner, think better, and perform better. |

| COURSE CODE | BEE306D PHYSICS OF ELECTRONIC DEVICES |
|---|---|
| CO1 | Understand the principles of semiconductor physics |
| CO2 | Understand the principles and characteristics of different types of semiconductor devices |
| CO3 | Understand the fabrication process of semiconductor devices |
| CO4 | Utilize the mathematical models of MOS transistors for circuits and systems |
| CO5 | Identify the mathematical models of MOS transistors for circuits and systems |

| COURSE CODE | BEE401 ELECTRIC MOTORS |
|---|---|
| CO1 | Understand the construction and operation, characteristics, Testing of DC Motors and determine losses and efficiency. |
| CO2 | Understand the construction and operation, classification and types of Three phase Induction motors. |
| CO3 | Describe the performance characteristics and applications of three phase Induction motors. |
| CO4 | Demonstrate and explain Speed Control methods of three phase induction motor and types of single phase induction motors. |
| CO5 | Understand the construction and operation, V and inverted V curves of synchronous motors. |
| CO6 | Construction and operation of Universal motor, AC servomotor, Linear induction motor, PMSM, SRM and BLDC motors. |

| COURSE CODE | BEE402 Transmission and Distribution |
|---|---|
| CO1 | Explain the structure of electrical power system, its components, advantages of high voltage AC and DC transmission, various conductors used for transmission, sag and its calculation. |
| CO2 | Explain various types of insulators and methods to improve string efficiency. |
| CO3 | Explain the various transmission line parameters, their effects on transmission of electricity. |
| CO4 | Evaluate the parameters that influence the performance of transmission line and to calculate performance parameters of various transmission lines. |
| CO5 | Explain carona and its effects, underground cable and its construction, classification, limitations and specifications. |
| CO6 | Evaluate different types of distribution systems. |

| COURSE CODE | BEE403Microcontrollers |
|---|---|
| CO1 | Outline the 8051 architecture, registers, internal memory organization, addressing modes. |
| CO2 | Discuss 8051 addressing modes, instruction set of 8051, accessing data and I/O port programming. |
| CO3 | Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and timer/counter programming. |
| CO4 | Summarize the basics of serial communication and interrupts, also develop 8051 programs for serial data communication and interrupt programming. |
| CO5 | Program 8051to work with external devices for ADC, DAC, Stepper motor control, DC motor control |
| CO6 | Develop various 8051 based projects. |

| COURSE CODE | BEEL404  Electric Motors Lab |
|---|---|
| CO1 | Perform tests on DC Machines to determine their characteristics. |
| CO2 | Control the DC Motors using different methods. |

| CO3 | Pre-determination the performance characteristics of DC Machines. |
|---|---|
| CO4 | Conduct load test on single-phase and three-phase Induction Motor and draw performance characteristics. |
| CO5 | Conduct test on Induction Motor to determine performance characteristics. |
| CO6 | Conduct test on synchronous motor to draw performance curves. |
| **COURSE CODE** | **BEE405A   Electrical Power Generation and Economics** |
| CO1 | Explain the basics of hydro electric power plant, merits and demerits of hydroelectric power plants, site selection, arrangement and elements of hydro electric plant. |
| CO2 | Explain the working, site selection and arrangement of Steam, Diesel and Gas Power Plants. |
| CO3 | Explain the working, site selection and arrangement of Nuclear Power Plants. |
| CO4 | Explain the importance of different equipments in substation, Interconnection of power stations and different types of grounding. |
| CO5 | Explain the economics of power generation. |
| **COURSE CODE** | **BEE405B OPAMPS AND LIC** |
| CO1 | Explain the basics of linear ICs. |
| CO2 | Design circuits using linear ICs |
| CO3 | Demonstrate the application of Linear ICs. |
| CO4 | Use ICs in the electronic projects |
| **COURSE CODE** | **BEE405C   Engineering Materials** |
| CO1 | Explain wave particle duality, tunnelling phenomenon, electron theory of metals. |
| CO2 | Explain the free electron theory of conduction in metals. |
| CO3 | Explain the polarization under static fields, behavior of dielectrics in alternating fields, Inorganic materials, organic materials, ), resins and varnishes, liquid insulators. |
| CO4 | Explain the mechanism of conduction in semiconductors. |
| CO5 | Explain the magnetic materials, their classification and magneto materials. |
| **COURSE CODE** | **BEE405D  Object Oriented Programming** |
| CO1 | Discuss the basic Object Oriented concepts. |
| CO2 | Develop applications using Object Oriented Programming Concepts. |
| CO3 | Implement features of object oriented programming to solve real world problems. |
| **COURSE CODE** | **BEE456A   BASICS OF –VHDL LAB** |
| CO1 | Write the VHDL/Verilog programs to simulate combinational circuits in data flow, behavioral, gate level abstractions. |
| CO2 | Describe sequential circuits like flip-flops, counters, in behavioral descriptions and obtain simulated waveforms. |
| CO3 | Use FPGA/CPLD kits for downloading Verilog codes and check output. |
| CO4 | Synthesize combinational and sequential circuits on programmable ICs and test the hardware |
| CO5 | Interface the hardware programmable chips and obtain the required output. |
| **COURSE CODE** | **BEEL456B Scilab / MATLAB for Electrical and Electronic Measurements** |
| CO1 | Analyse in a systematic way, think better, and perform better. |
| **COURSE CODE** | **BEEL456C   PCB Design Laboratory** |
| CO1 | Analyse in an intelligent manner, think better, and perform better. |

| COURSE CODE | BEEL456D   ARDUINO AND RASPBERRY PI |
|---|---|
| CO1 | Explain the concepts of Internet of Things and its hardware and software components |
| CO2 | Interface I/O devices, sensors & communication modules |
| CO3 | Remotely monitor data and control devices |
| CO4 | Develop real life IoT based projects. |

## ELECTRICAL & ELECTRONICS ENGINEERING
## 2021 SCHEME COs

| COURSE CODE | 21ELE13   BASIC ELECTRICAL ENGINEERING |
|---|---|
| CO1 | Analyse basic DC and AC electric circuits. |
| CO2 | Explain the working principles of transformers and electrical machines |
| CO3 | Explain the concepts of electric power transmission and distribution of power |
| CO4 | Understand the wiring methods, electricity billing, and working principles of circuit protectivedevices and personal safety measures. |

| COURSE CODE | 21ELE23   BASIC ELECTRICAL ENGINEERING |
|---|---|
| CO1 | Analyse basic DC and AC electric circuits. |
| CO2 | Explain the working principles of transformers and electrical machines |
| CO3 | Explain the concepts of electric power transmission and distribution of power |
| CO4 | Understand the wiring methods, electricity billing, and working principles of circuit protectivedevices and personal safety measures. |

| COURSE CODE | 21MAT31 Transform Calculus, Fourier Series and Numerical Techniques (Common to all Branches) |
|---|---|
| CO1 | To solve ordinary differential equations using Laplace transform. |
| CO2 | Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory. |
| CO3 | To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations |
| CO4 | To solve mathematical models represented by initial or boundary value problems involving partial differential equations |
| CO5 | Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis. |

| COURSE CODE | 21EE32  Analog Electronic Circuits and Op - Amps |
|---|---|
| CO1 | Obtain the output characteristics of clipper and clamper circuits |
| CO2 | Design and compare biasing circuits for transistor amplifiers & explain the transistor switching. |
| CO3 | Explain the concept of feedback, its types and design of feedback circuits |

| CO4 | Design and analyse the power amplifier circuits and oscillators for different frequencies. |
|---|---|
| CO5 | Design and analysis of FET and MOSFET amplifiers. |
| CO6 | Demonstrate the application of Op-amps. |
| **COURSE CODE** | **21EE33  Electric circuit Analysis** |
| CO1 | Understand the basic concepts, basic laws and methods of analysis of DC and AC networks and reduce the complexity of network using source shifting, source transformation and network reduction using transformations. |
| CO2 | Solve complex electric circuits using network theorems. |
| CO3 | Discuss resonance in series and parallel circuits and also the importance of initial conditions and their evaluation. |
| CO4 | Synthesize typical waveforms using Laplace transformation. |
| CO5 | Solve unbalanced three phase systems and also evaluate the performance of two port networks. |
| **COURSE CODE** | **21EE34   Transformer and generators** |
| CO1 | Understand the construction and operation of 1-phase, 3-Phase transformers, and Autotransformer. |
| CO2 | Analyze the performance of transformers by polarity test, Sumpner's Test, phase conversion, 3-phase connection, and parallel operation. |
| CO3 | Understand the construction and working of AC and DC Generators |
| CO4 | Analyze the performance of the AC Generators on infinite bus and parallel operation |
| CO5 | Determine the regulation of AC Generator by Slip test, EMF, MMF, and ZPF Methods. |
| | |
| **COURSE CODE** | **21EEL35 Electrical Machines Laboratory - 1** |
| CO1 | Evaluate the performance of transformers from the test data obtained. |
| CO2 | Connect and operate two single phase transformers of different KVA rating in parallel. |
| CO3 | Connect single phase transformers for three phase operation and phase conversion. |
| CO4 | Compute the voltage regulation of synchronous generator using the test data obtained in the laboratory |
| CO5 | Evaluate the performance of synchronous generators from the test data and assess the performance of synchronous generator connected to infinite bus. |
| | |
| **COURSE CODE** | **21EEL381 Scilab for Transformers and Generators** |
| CO1 | Analyse in an intelligent manner, think better, and perform better. |

| COURSE CODE | 21EEL382 Circuit Laboratory using Pspice |
|---|---|
| CO1 | Analyse in an intelligent manner, think better, and perform better. |
| | |

| COURSE CODE | 21EEL383 555 IC Laboratory |
|---|---|
| CO1 | Analyse in an intelligent manner, think better, and perform better. |
| | |

| COURSE CODE | 21EEL384 Scilab for Mathematics |
|---|---|
| CO1 | Analyse in an intelligent manner, think better, and perform better. |
| | |

| COURSE CODE | 21MAT41 Complex Analysis, Probability and Statistical Methods |
|---|---|
| CO1 | Use the concepts of an analytic function and complex potentials to solve the problems arising in electromagnetic field theory. Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing. |
| CO2 | Obtain Series Solutions of Ordinary Differential Equation. |
| CO3 | Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data. |
| CO4 | Apply discrete and continuous probability distributions in analysing the probability models arising in the engineering field. |
| CO5 | Construct joint probability distributions and demonstrate the validity of testing the hypothesis. |

| COURSE CODE | 21EE42 Digital System Design |
|---|---|
| CO1 | Develop simplified switching equation using Karnaugh Maps and QuineMcClusky techniques. |
| CO2 | Design Multiplexer, Encoder, Decoder, Adder, Subtractors and Comparator as digital combinational control circuits |
| CO3 | Design flip flops, counters, shift registers as sequential control circuits. |
| CO4 | Develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits. |
| CO5 | Explain the functioning of Read only and Read/Write Memories, Programmable ROM, EPROM and Flash memory. |
| CO6 | Realize Boolean expressions, adders and subtractors using gates. |
| CO7 | Design and test Ring counter/Johnson counter, Sequence generator and 3 bit counters. |

| COURSE CODE | 21EE43 Microcontroller |
|---|---|
| CO1 | Outline the 8051 architecture, registers, internal memory organization, addressing modes. |
| CO2 | Discuss 8051 addressing modes, instruction set of 8051, accessing data and I/O port programming. |
| CO3 | Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and timer/counter programming. |
| CO4 | Summarize the basics of serial communication and interrupts, also develop 8051 programs for serial data communication and interrupt programming. |
| CO5 | Program 8051to work with external devices for ADC, DAC, Stepper motor control, DC motor control. |

| COURSE CODE | 21EE44  Electric Motors |
|---|---|
| CO1 | Explain the construction, operation and classification of DC Motor, AC motor and special purpose motors. |
| CO2 | Describe the performance characteristics and applications of Electric motors. |
| CO3 | Demonstrate and explain the methods of testing of DC machines and determine losses and efficiency. |
| CO4 | Control the speed of DC motor and induction motor. |
| CO5 | Explain the starting methods, equivalent circuit and phasor diagrams, torque angle, effect of change in excitation and change in load, hunting and damping of synchronous motors. |

| COURSE CODE | 21EEL46 Electrical Machines Laboratory - 2 |
|---|---|
| CO1 | Test DC machines to determine their characteristics and also to control the speed of DC motor. |
| CO2 | Pre-determine the performance characteristics of DC machines by conducting suitable tests. |
| CO3 | Perform load test on single phase and three phase induction motor to assess its performance. |
| CO4 | Conduct test on induction motor to pre-determine the performance characteristics. |
| CO5 | Conduct test on synchronous motor to draw the performance curves |

| COURSE CODE | 21EEP481 Microcontroller Based Projects |
|---|---|
| CO1 | Analyse in a systematic way, think better, and perform better. |

| COURSE CODE | 21EEL482 Scilab for Electric Motors |
|---|---|
| CO1 | Analyse in a systematic way, think better, and perform better. |

| COURSE CODE | 21EEL483 Scilab for Electrical and Electronic Measurements |
| --- | --- |
| CO1 | Analyse in a systematic way, think better, and perform better. |

| COURSE CODE | 21EEL484 Simulation of Op-Amp Circuits |
| --- | --- |
| CO1 | Analyse in a systematic way, think better, and perform better. |

| COURSE CODE | 21EE51 Transmission and Distribution |
| --- | --- |
| CO1 | Explain transmission and distribution scheme, identify the importance of different transmission systems and types of insulators. |
| CO2 | Analyze and compute the parameters of the transmission line for different configurations. |
| CO3 | Assess the performance of overhead lines. |
| CO4 | Interpret corona, explain the use of underground cables. |
| CO5 | Classify different types of distribution systems; examine its quality & reliability. |

| COURSE CODE | 21EE52 Control Systems |
| --- | --- |
| CO1 | Analyze and model electrical and mechanical system using analogous. |
| CO2 | Formulate transfer functions using block diagram and signal flow graphs |
| CO3 | Analyze the stability of control system, ability to determine transient and steady state time response. |
| CO4 | Illustrate the performance of a given system in time and frequency domains, stability analysis using Root locus and Bode plots. |
| CO5 | Discuss stability analysis using Nyquist plots, Design controller and compensator for a given specification. |
| CO6 | Utilize software package and discrete components in assessing the time and frequency domain response of a given second order system. |
| CO7 | Design, analyze and simulate Lead, Lag and Lag – Lead compensators for given specifications. |
| CO8 | Determine the performance characteristics of ac and DC servomotors and synchro-transmitter receiver pair used in control systems. |
| CO9 | Simulate the DC position and feedback control system to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system. |
| CO10 | Develop a script files to plot Root locus, Bode plot and Nyquist plot to study the stability of a system using software package. |

| COURSE CODE | 21EE53 Power System Analysis - 1 |
|---|---|
| CO1 | Model the power system components & construct per unit impedance diagram of power system. |
| CO2 | Analyze three phase symmetrical faults on power system. |
| CO3 | Compute unbalanced phasors in terms of sequence components and vice versa, also develop sequence networks. |
| CO4 | Analyze various unsymmetrical faults on power system. |
| CO5 | Examine dynamics of synchronous machine and determine the power system stability. |
| Course Code | 21EE54 Power Electronics |
| CO1 | To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics, power diode characteristics, types, their operation and the effects of power diodes on RL circuits. |
| CO2 | To explain the techniques for design and analysis of single phase diode rectifier circuits. |
| CO3 | To explain different power transistors, their steady state and switching characteristics and limitations. |
| CO4 | To explain different types of Thyristors, their gate characteristics and gate control requirements. |
| CO5 | To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers. |
| Course Code | 21EEL55 Power Electronics Laboratory |
| CO1 | Obtain static characteristics of semiconductor devices to discuss their performance. |
| CO2 | Trigger the SCR by different methods |
| CO3 | Verify the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads. |
| CO4 | Control the speed of a DC motor, universal motor and stepper motors. |
| CO5 | Verify the performance of single phase full bridge inverter connected to resistive load. |
| Course Code | 21EEL581 Scilab for Analysis of Power Systems |
| CO1 | Analyse in an intelligent manner, think better, and perform better. |
| Course Code | 21EEL582 Scilab for Power Electronics |
| CO1 | Analyse in an intelligent manner, think better, and perform better. |
| Course Code | 21EEP583 Energy Audit Project |
| CO1 | To analyze the data collected for energy audit of a building or industry or organization. |
| CO2 | To perform comparative analysis with and without energy audit. |
| CO3 | To analyze the energy saving measures to be considered with economy considerations. |

| CO4 | Analyse in a systematic way, think better, and perform better. |
|---|---|
| **Course Code** | **21EEP584 Renewable Energy Projects** |
| CO1 | Analyse in a systematic way, think better, and perform better. |
| **Course Code** | **21EE61 Management and Entrepreneurship** |
| CO1 | Explain the field of management, task of the manager, planning and steps in decision making. |
| CO2 | Discuss the structure of organization, importance of staffing, leadership styles, modes of communication, techniques of coordination and importance of managerial control in business. |
| CO3 | Explain the concepts of entrepreneurship and a businessman's social responsibilities towards different groups. |
| CO4 | Show an understanding of role of SSI's in the development of country and state/central level institutions/ agencies supporting business enterprises. |
| CO5 | Discuss the concepts of project management, capital budgeting, project feasibility studies, need for project report and new control techniques. |
| **Course Code** | **21EE62 Power System Analysis - 2** |
| CO1 | Formulate network matrices and models for solving load flow problems. |
| CO2 | Perform steady state power flow analysis of power systems using numerical iterative techniques. |
| CO3 | Solve issues of economic load dispatch and unit commitment problems. |
| CO4 | Analyze short circuit faults in power system networks using bus impedance matrix. |
| CO5 | Apply Point by Point method and Runge Kutta Method to solve Swing Equation. |
| CO6 | Develop a program in suitable package to assess the performance of medium and long transmission lines. |
| CO7 | Develop a program in suitable package to obtain the power angle characteristics of salient and non-salient pole alternator. |
| CO8 | Develop a program in suitable package to assess the transient stability under three phase fault at different locations in a of radial power systems. |
| **Course Code** | **21EE63 Signals and Digital Signal Processing** |
| CO1 | Discuss classification and basic operations that can be performed on both continuous and discrete time signals. |
| CO2 | Evaluate Discrete Fourier Transform of a sequence and the convolution of two sequences to determine the output sequence. |
| CO3 | Evaluate Discrete Fourier Transform of a sequence by using fast methods. |
| CO4 | Design Butterworth and Chebyshev IIR digital filters and FIR filters using different techniques. |
| CO5 | Develop different structures for IIR and FIR filters. |

| Course Code | 21EE641 Sensors and Transducers |
|---|---|
| CO1 | Classify the transducers and explain the need of transducers, their classification, advantages and disadvantages. |
| CO2 | Explain the working of various transducers and sensors. |
| CO3 | Outline the recent trends in sensor technology and their selection |
| CO4 | Analyze the signal conditioning and signal conditioning equipment. |
| CO5 | Illustrate different configuration of Data Acquisition System and data conversion. |
| CO6 | Show knowledge of data transmission and telemetry. |
| CO7 | Explain measurement of non-electrical quantities -temperature, flow, speed, force, torque, power and viscosity. |
| Course Code | 21EE642 Electromagnetic Field Theory |
| CO1 | Use different coordinate systems, Coulomb's Law and Gauss Law for the evaluation of electric fields produced by different charge configurations. |
| CO2 | Calculate the energy and potential due to a system of charges & Explain the behavior of electric field across a boundary conditions |
| CO3 | Explain the Poisson's, Laplace equations and behavior of steady magnetic fields. |
| CO4 | Explain the behavior of magnetic fields and magnetic materials. |
| CO5 | Asses time varying fields and propagation of waves in different media. |
| Course Code | 21EE643 Electrical Machine Design |
| CO1 | Identify and list, limitations, modern trends in design, manufacturing of electrical machines and properties of materials used in the electrical machines. |
| CO2 | Derive the output equation of DC machine, discuss selection of specific loadings and magnetic circuits of DC machines, design the field windings of DC machine, and design stator and rotor circuits of a DC machine. |
| CO3 | Derive the output equations of transformer, discuss selection of specific loadings, estimate the number of cooling tubes, no load current and leakage reactance of core type transformer. |
| CO4 | Develop the output equation of induction motor, discuss selection of specific loadings and magnetic circuits of induction motor, design stator and rotor circuits of a induction motor. |
| CO5 | Formulate the output equation of alternator, design the field windings of Synchronous machine, discuss short circuit ratio and its effects on performance of synchronous machines, design salient pole and non-salient pole alternators for given specifications. |

| Course Code | 21EE644 Electrical Engineering Materials |
|---|---|
| CO1 | Discuss electrical and electronics materials, their importance, classification and operational requirement |
| CO2 | Discuss conducting, dielectric, insulating and magnetic materials used in engineering, their properties and classification. |
| CO3 | Explain the phenomenon superconductivity, super conducting materials and their application in engineering. |
| CO4 | Explain the plastic and its properties and applications. |
| Course Code | 21EE651 Utilization of Electrical Power |
| CO1 | Discuss different methods of electric heating & welding. |
| CO2 | Discuss the laws of electrolysis, extraction, refining of metals and electro deposition process. |
| CO3 | Discuss the laws of illumination, different types of lamps, lighting schemes and design of lighting systems. |
| CO4 | Analyze systems of electric traction, speed time curves and mechanics of train movement. |
| CO5 | Explain the motors used for electric traction, their control & braking and power supply system used for electric traction. |
| Course Code | 21EE652 Renewable Energy Resources |
| CO1 | Discuss causes of energy scarcity and its solution, energy resources and availability of renewable energy. |
| CO2 | Outline energy from sun, energy reaching the Earth's surface and solar thermal energy applications. |
| CO3 | Discuss types of solar collectors, their configurations, solar cell system, its characteristics and their applications. |
| CO4 | Explain generation of energy from hydrogen, wind, geothermal system, solid waste and agriculture refuse. |
| CO5 | Discuss production of energy from biomass, biogas. |
| CO6 | Summarize tidal energy resources, sea wave energy and ocean thermal energy. |
| Course Code | 21EE653 Industrial Servo Control Systems |
| CO1 | Explain the evolution and classification of servos, with descriptions of servo drive actuators, amplifiers, feedback transducers, performance, and troubleshooting techniques. |
| CO2 | Discuss system analogs, vectors and transfer functions of differential equations. |
| CO3 | Discuss mathematical equations for electric servo motors, both DC and brushless DC servo motors. |
| CO4 | Discuss mathematical equations for electric servo motors, both DC and brushless DC servo motors. |
| Course Code | 21EE654 Advanced Control Systems |
| CO1 | Discuss state variable approach for linear time invariant systems in both the continuous and discrete time systems. |
| CO2 | Develop of state models for linear continuous–time and discrete–time systems. |
| CO3 | Apply vector and matrix algebra to find the solution of state equations for linear continuous–time and discrete–time systems. |

| CO4 | Define controllability and observability of a system and test for controllability and observability of a given system. |
|------|------|
| CO5 | Design pole assignment and state observer using state feedback. |
| CO6 | Develop the describing function for the nonlinearity present to assess the stability of the system. |
| CO7 | Develop Lyapunov function for the stability analysis of nonlinear systems |
| **Course Code** | **21EEL66 Digital Signal Processing Laboratory** |
| CO1 | Conduct sampling of signals in time and frequency domains. |
| CO2 | Evaluate the impulse response of a system. |
| CO3 | Obtain convolution of given sequences to evaluate the response of a system. |
| CO4 | Compute DFT and IDFT of a given sequence using the basic definition and/or fast methods. |
| CO5 | Provide a solution for a given difference equation. |
| CO6 | Design and implement IIR and FIR filters. |
| **Course Code** | **21EE71 High Voltage and Power System Protection** |
| CO1 | Apply the knowledge of dielectric property for insulation, it's performances as per Standards and High voltage application in power system Equipment's. |
| CO2 | Analyze the circuits of high voltages, high currents in Generation and Measurements. |
| CO3 | Apply relays to the power system protection. |
| CO4 | Discuss the construction, operating principles and performances of circuit breaker. |
| CO5 | Discuss protection of generators, motors, Transformer and Bus Zone Protection. |
| CO6 | Describe the causes of over voltages and their remedial measures. |
| CO7 | Analyze the spark over characteristics using High voltages for checking the breakdown phenomenon and dielectric strength of dielectric materials |
| CO8 | Experimentally verify the characteristics of over current, over voltage, under voltage using electromagnetic, static, distance and impedance relays. |
| CO9 | Demonstration of protective schemes for motor and feeders. |

| **Course Code** | **21EE72 Power System Operation and Control** |
|------|------|
| CO1 | Describe various levels of controls in power systems, architecture and configuration of SCADA. |
| CO2 | Develop and analyze mathematical models of Automatic Load Frequency Control. |
| CO3 | Develop mathematical model of Automatic Generation Control in Interconnected Power system. |
| CO4 | Discuss the Control of Voltage, Reactive Power and Voltage collapse. |

| CO5 | Explain security, contingency analysis, and state estimation of power systems. |
|---|---|
| **Course Code** | **21EE721 Power System Planning** |
| CO1 | Discuss primary components of power system planning, planning methodology for optimum power system expansion and load forecasting. |
| CO2 | Understand economic appraisal to allocate the resources efficiently and appreciate the investment decisions |
| CO3 | Discuss expansion of power generation and planning for system energy in the country, evaluation of operating states of transmission system, their associated contingencies and the stability of the system. |
| CO4 | Discuss principles of distribution planning, supply rules, network development and the system studies |
| CO5 | Discuss reliability criteria for generation, transmission, distribution and reliability evaluation and analysis, grid reliability, voltage disturbances and their remedies |
| CO6 | Discuss planning and implementation of electric –utility activities, market principles and the norms framed. |
| **Course Code** | **21EE722 Smart Grid** |
| CO1 | Discuss the progress made by different stakeholders in the design and development of smart grid. |
| CO2 | Explain measurement techniques using Phasor Measurement Units and smart meters |
| CO3 | Discuss tools for the analysis of smart grid and design, operation and performance |
| CO4 | Discuss classical optimization techniques and computational methods for smart grid design, planning and operation. |
| CO5 | Explain predictive grid management and control technology for enhancing the smart grid performance |
| CO6 | Develop cleaner, more environmentally responsible technologies for the electric system. |
| CO7 | Discuss the computational techniques, communication, measurement, and monitoring technology tools essential to the design of the smart grid. |
| CO8 | Explain methods to promote smart grid awareness and making the existing transmission system smarter by investing in new technology. |
| **Course Code** | **21EE723 ANN with Applications to Power Systems** |
| CO1 | Develop Neural Network and apply elementary information processing tasks that neural network can solve. |
| CO2 | Develop Neural Network and apply powerful, useful learning techniques. |
| CO3 | Develop and Analyze multilayer feed forward network for mapping provided through the first network layer and error back propagation algorithm. |
| CO4 | Analyze and apply algorithmic type problems to tackle problems for which algorithms are not available. |
| CO5 | Develop and Analyze supervised/unsupervised, learning modes of Neural Network for different applications. |
| **Course Code** | **21EE724 Electrical Vehicle Technologies** |
| CO1 | Explain the working of electric vehicles and recent trends. |

| CO2 | Analyze different power converter topology used for electric vehicle application. |
|---|---|
| CO3 | Develop the electric propulsion unit and its control for application of electric vehicles. |
| CO4 | Design converters for battery charging and explain transformer less topology. |
| **Course Code** | **21EE725 PLC and SCADA** |
| CO1 | Discuss history of PLC and describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming. |
| CO2 | Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module. |
| CO3 | Analyze PLC timer and counter ladder logic programs and describe the operation of different program control instructions |
| CO4 | Discuss the execution of data transfer instructions, data compare instructions and the basic operation of PLC closed-loop control system. |
| CO5 | Describe the operation of mechanical sequencers, bit and word shift registers, processes and structure of control systems and communication between the processes. |
| **Course Code** | **21EE731 Computer Aided Electrical Drawing** |
| CO1 | Develop armature winding diagram for DC and AC machines. |
| CO2 | Develop a Single Line Diagram of Generating Stations and substation using the standard symbols. |
| CO3 | Construct sectional views of core type and shell type transformers using the design data. |
| CO4 | Construct sectional views of assembled DC and AC machine and their parts using the design data or the sketches. |
| **Course Code** | **21EE732 Micro- and Nano-Scale Sensors and Transducers** |
| CO1 | Understand the differences between the sensor and transducer technology based on nanotechnology and nanofabrication and the classical sensor technologies |
| CO2 | Make an informed selection of a sensor or transducer for a particular application |
| CO3 | Become knowledgeable about the technologies that are available commercially at the present time. |
| **Course Code** | **21EE733 Big Data Analytics in Power Systems** |
| CO1 | Discuss role of big data and machine-learning methods applicable to power systems and in particular to Smart Grid communications. |
| CO2 | Discuss optimization methods which are suitable for big data models in power systems. |
| CO3 | Discuss various cyber security issues, electricity theft detection and mitigation that exist in IoT-enabled future power systems. |

| CO4 | Discuss renewable energy planning concerns associated with planned future power systems that have high renewable penetration. |
|---|---|
| **Course Code** | **21EE734 Industrial Drives and Applications** |
| CO1 | Explain the advantages, choice and control of electric drive |
| CO2 | Explain the dynamics, generating and motoring modes of operation of electric drives |
| CO3 | Explain the selection of motor power rating to suit industry requirements |
| CO4 | Analyze the performance & control of DC motor drives using controlled rectifiers |
| CO5 | Analyze the performance & control of converter fed Induction motor, synchronous motor & stepper motor drives. |
| **Course Code** | **21EE735  FACTS and HVDC** |
| CO1 | Discuss transmission interconnections, flow of Power in an AC System, limits of the loading capability, dynamic stability considerations of a transmission interconnection and controllable parameters. |
| CO2 | Explain the basic concepts, definitions of flexible ac transmission systems and benefits from FACTS technology. |
| CO3 | Describe shunt controllers, Static Var Compensator and Static Compensator for injecting reactive power in the transmission system in enhancing the controllability and power transfer capability. |
| CO4 | Describe series Controllers Thyristor-Controlled Series Capacitor (TCSC) and the Static Synchronous Series Compensator (SSSC) for control of the transmission line current. |
| CO5 | Explain advantages of HVDC power transmission, overview and organization of HVDC system. |
| CO6 | Describe the basic components of a converter, the methods for compensating the reactive power demanded by the converter. |
| CO7 | Explain converter control for HVDC systems, commutation failure, control functions. |
| **Course Code** | **21EE741 Carbon Capture and Storage** |
| CO1 | Discuss the impacts of climate change and the measures that can be taken to reduce emissions. |
| CO2 | Discuss carbon capture and carbon storage. |
| CO3 | Explain the fundamentals of power generation. |
| CO4 | Explain methods of carbon capture from power generation and industrial processes. |
| CO5 | Explain different carbon storage methods: storage in coal seams, depleted gas reservoirs and saline formations. |
| CO6 | Explain Carbon dioxide compression and pipeline transport. |
| **Course Code** | **21EE742 Electric Vehicles** |
| CO1 | Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design. |
| CO2 | Explain the working of electric vehicles and hybrid electric vehicles in recent trends. |
| CO3 | Model batteries, Fuel cells, PEMFC and super capacitors |

| CO4 | Analyze DC and AC drive topologies used for electric vehicle application. |
|---|---|
| CO5 | Develop the electric propulsion unit and its control for application of electric vehicles. |
| **Course Code** | **21EE743 Disasters Management** |
| CO1 | Discuss disaster management plan, cyclones and their hazard potential |
| CO2 | Understand the role of IMD and cyclone prediction and cyclone warning system in India |
| CO3 | Understand the role of different institutions defence and other services in natural disaster management. |
| CO4 | Understand the role of Central Water Commission in river water sharing, Draught, its assessment and drau management plan |
| CO5 | Understand occurrence of earth quake, Tsunamis and thunderstorms. |
| **Course Code** | **21EE744 Electrical Power Quality** |
| CO1 | Define Power quality; evaluate power quality procedures and standards. |
| CO2 | Estimate voltage sag performance; explain principles of protection and Sources of transient over voltages. |
| CO3 | Identify various sources of harmonics, explain effects of harmonic distortion. |
| CO4 | Evaluate harmonic distortion, control harmonic distortion. |
| CO5 | Estimate power quality in distribution planning. Identify power quality issues in utility system. |
| **Course Code** | **21EE745 Energy Conservation and Audit** |
| CO1 | Analyze about energy scenario nationwide and worldwide , also outline Energy Conservation Act and its fe |
| CO2 | Discuss load management techniques and energy efficiency. |
| CO3 | Understand the need of energy audit and energy audit methodology. |
| CO4 | Understand various pillars of electricity market design. |
| CO5 | Conduct energy audit of electrical systems and buildings. |
| CO6 | Show an understanding of demand side management and energy conservation. |

# PROGRAMME OUTCOME, PROGRAMMESPECIFIC OUTCOMES AND COURSEOUTCOMES OF ALL DEPARTMENTS–2023-24(CRITERIA- 2)

## Department of Mechanical Engineering

**Program Outcomes (PO's)**

**PO 1: Engineering Knowledge:** Apply the knowledge of Mathematics, Science, Mechanical Engineering, Engineering fundamentals, to the solution of complex engineering problems.

**PO 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.

**PO 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, societal, and environmental considerations.

**PO 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.

**PO 5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, including prediction and modeling to complex Engineering activities with an understanding of the limitations.

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

**PO 7: Environment and sustainability**: Understand the impact of the professional Engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable developments.

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

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

**PO 10: Communication:** Communicate effectively on complex Engineering activities with the Engineering Community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO 11: Project management and finance:** Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

**PO 12: Life-long Learning:** Recognize the need for identifying contemporary technical challenges and redefining to develop solutions to satisfy given criteria in an optimal manner using creativity in design.

**Program Specific Outcomes (PSO's)**

**PSO 1:** Apply their knowledge in the domain of engineering mechanics, thermal and fluid sciences to solve engineering problems utilizing advanced technology.

**PSO 2:** Successfully apply the principles of design, analysis and implementation of mechanical systems/processes which have been learned as a part of the curriculum.

**PSO 3:** Develop and implement new ideas on product design and development with the help of modern CAD/CAM tools, while ensuring best manufacturing practices.

| | COURSE OUTCOMES MECHANICAL ENGINEERING (2022 SCHEME UG) |
|---|---|
| **Course Code** | **BIDTK158/258 - INNOVATION and DESIGN THINKING** |
| CO1 | Appreciate various design process procedure |
| CO2 | Generate and develop design ideas through different technique |
| CO3 | Identify the significance of reverse Engineering to Understand products |
| CO4 | Draw technical drawing for design ideas |
| **Course Code** | **BCEDK103/203 - Computer Aided Engineering Drawing** |
| CO1 | Draw and communicate the objects with definite shape and dimensions |
| CO2 | Recognize and Draw the shape and size of objects through different views |
| CO3 | Develop the lateral surfaces of the object |
| CO4 | Create a Drawing views using CAD software. |
| CO5 | Identify the interdisciplinary engineering components or systems through its graphical representation. |
| **Course Code** | **BEMEM103/203 - ELEMENTS OF MECHANICAL ENGINEERING** |
| CO1 | Explain the role of mechanical engineering in industry and society, fundamentals of steam and non-conventional energy sources |
| CO2 | Describe different conventional and advanced machining processes, IC engines, propulsive devices, air-conditioning, refrigeration. |
| CO3 | Explain different gear drives, gear trains, aspects of future mobility and fundamentals of robotics |
| CO4 | Determine the condition of steam and its energy, performance parameters of IC engines, velocity ratio and power transmitted through power transmission systems. |
| **Course Code** | **BESCK104D/204D - INTRODUCTION TO MECHANICAL ENGINEERING** |
| CO1 | Explain the concepts of Role of Mechanical Engineering and Energy sources. |
| CO2 | Describe the Machine Tool Operations and advanced Manufacturing process. |

| CO3 | Explain the Working Principle of IC engines and EV vehicles. |
|---|---|
| CO4 | Discuss the Properties of Common Engineering Materials and various Metal Joining Processes. |
| CO5 | Explain the Concepts of Mechatronics, Robotics and Automation in IoT |
| **Course Code** | **BETCK105E/205E -RENEWABLE ENERGY SOURCES** |
| CO1 | Describe the environmental aspects of renewable energy resources. In Comparison with various conventional energy systems, their prospects and limitations. |
| CO2 | Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation. |
| CO3 | Understand the conversion principles of wind and tidal energy |
| CO4 | Understand the concept of biomass energy resources and green energy. |
| CO5 | Acquire the basic knowledge of ocean thermal energy conversion and hydrogen energy. |
| **Course Code** | **BME302 - MANUFACTRUING PROCESS** |
| CO1 | Describe the casting process and prepare different types of cast products. Acquire knowledge on Pattern, Core, Gating, Riser system and to use Jolt, Squeeze, and Sand Slinger Moulding machines. |
| CO2 | Compare the Gas fired pit, Resistance, Coreless, Electrical and Cupola Metal Furnaces. Compare the Gravity, Pressure die, Centrifugal, Squeeze, slush and Continuous Metal mold castings. |
| CO3 | Understand the Solidification process and Casting of Non-Ferrous Metals. |
| CO4 | Describe the Metal Arc, TIG, MIG, Submerged and Atomic Hydrogen Welding processes etc. used in manufacturing. |
| CO5 | Describe the methods of different joining processes and thermal effects in joining process |
| **Course Code** | **BME303 - MATERIAL SCIENCE AND ENGINEERING** |
| CO1 | Understand the atomic arrangement in crystalline materials and describe the periodic arrangement of atoms in terms of unit cell parameters. |

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|---|---|
| CO2 | Understand the importance of phase diagrams and the phase transformations. |
| CO3 | Explain various heat treatment methods for controlling the microstructure.. |
| CO4 | Correlate between material properties with component design and identify various kinds of defects. |
| CO5 | Apply the method of materials selection, material data and knowledge sources for computer- aided selection of materials. |
| **Course Code** | **BME304 - BASIC THERMODYNAMICS** |
| CO1 | Explain fundamentals of thermodynamics and evaluate energy interactions across the boundary of thermodynamic systems. |
| CO2 | Apply 1st law of thermodynamics to closed and open systems and determine quantity of energy transfers. |
| CO3 | Evaluate the feasibility of cyclic and non-cyclic processes using 2nd law of thermodynamics : Apply the knowledge of entropy, reversibility and irreversibility to solve numerical problems and Interpret the behaviour of pure substances and its application in practical problems. |
| CO4 | Recognize differences between ideal and real gases and evaluate thermodynamic properties of ideal and real gas mixtures using various relations. |
| **Course Code** | **BMEL305 - Introduction to Modelling and Design for Manufacturing** |
| CO1 | Demonstrate their visualization skills. |
| CO2 | Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies. Make component drawings. |
| CO3 | Produce the assembly drawings using part drawings. |
| CO4 | Engage in lifelong learning using sketching and drawing as communication tool. |
| **Course Code** | **BME306A - Electric and Hybrid Vehicle Technology** |
| CO1 | Understand the architecture and vehicle dynamics of electric and hybrid vehicles |
| CO2 | Analyze the power management systems for electric and hybrid vehicles |
| CO3 | Understand different motor control strategies for electric and hybrid vehicles |

| CO4 | Analyze various components of electric and hybrid vehicles with environment concern. |
|------|---------------------------------------------------------------|
| CO5 | Understand the domain related grid interconnections of electric and hybrid vehicle. |
| **Course Code** | **BME306B - Smart Materials & Systems** |
| CO1 | Apply the knowledge for materials characterization |
| CO2 | Evaluate the materials based on actuation |
| CO3 | Select and justify appropriate materials for specific application |
| **Course Code** | **BME306C - INTERNET OF THINGS** |
| CO1 | Explain the definition and usage of the term "Internet of Things" in different contexts |
| CO2 | Understand the key components that make up an IoT system |
| CO3 | Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack |
| CO4 | Apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis |
| CO5 | Understand where the IoT concept fits within the broader ICT industry and possible future |
| **Course Code** | **BME306D - WASTE HANDLING & MANAGEMENT** |
| CO1 | Identify & segregate the waste |
| CO2 | Formulate the appropriate waste segregation, collection & disposal system |
| CO3 | Generate a report on waste management challenges |
| CO4 | Select a remedial measure for environmental & living being protection |
| CO5 | Exercise the constitution laws as a citizen |
| **Course Code** | **BME358A - ADVANCED PYTHON PROGRAMMING** |
| CO1 | Develop algorithmic solutions to simple computational problems |

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| CO2 | Develop and execute simple Python programs |
| CO3 | Use functions to decompose a Python program |
| CO4 | Process compound data using Python data structures |
| CO5 | Utilize Python packages in developing software applications |
| **Course Code** | **BME358B - INTRODUCTION TO VIRTUAL REALITY** |
| CO1 | Describe how VR systems work and list the applications of VR. |
| CO2 | Demonstrate the design and implementation of the hardware that enables VR systems to be built. |
| CO3 | Understand the system of human vision and its implication on perception and rendering. |
| CO4 | Explain the concepts of motion and tracking in VR systems. |
| CO5 | Describe the importance of interaction and audio in VR systems. |
| **Course Code** | **BME358C - SPREADSHEET FOR ENGINEERS** |
| CO1 | Create different plots and charts |
| CO2 | Compute different functions, conditional functions and make regression analysis |
| CO3 | Carryout iterative solutions for roots, multiple roots, optimization and non-linear regression analysis |
| CO4 | Carryout matrix operations |
| **Course Code** | **BME358D - Tools in Scientific Computing** |
| CO1 | Understand the fundamentals of programming in scientific computations. |
| CO2 | Develop programming for curve fitting and solving both linear and nonlinear equations. |
| CO3 | Apply the concept of approximate methods and recognize their significance in computing. |
| CO4 | Apply MATLAB/MATHCAD/FORTRAN/PYTHON tools, etc., for solving engineering problems |
| **Course Code** | **BME401 - APPLIED THERMODYNAMICS** |
| CO1 | Analyse air standard cycle to evaluate the performance of I C engines. |

| CO2 | Analyze the gas power cycles to evaluate the overall efficiency of gas turbine plant. |
|------|------|
| CO3 | Apply thermodynamic concepts to analyze the performance of vapour power cycles. |
| CO4 | Analyze the vapour compression and vapour absorption systems to improve refrigeration. |
| CO5 | Determination of various parameters of air compressors and steam nozzles. |
| **Course Code** | **BME402 - MACHINING SCIENCE & METROLOGY** |
| CO1 | Analyze various cutting parameters in metal cutting. |
| CO2 | Understand the construction of machines & machine tools and compute the machining time of various operations. |
| CO3 | Understand the concept of Temperature in Metal Cutting, forms of wear in metal cutting and Cutting fluids |
| CO4 | Understand the objectives of metrology, methods of measurement, standards of measurement & various measurement parameters. Explain tolerance, limits of size, fits, geometric and position tolerances, gauges and their design |
| CO5 | Understand the working principle of different types of comparators, gauges, angular Measurements |
| **Course Code** | **BME403 - FLUID MECHANICS** |
| CO1 | Identify and calculate the key fluid properties used in the analysis of fluid behavior. |
| CO2 | Understand and apply the principles of pressure, buoyancy and floatation |
| CO3 | Apply the knowledge of fluid dynamics while addressing problems of mechanical and chemical engineering. |
| CO4 | Understand the concept of boundary layer in fluid flow and apply dimensional analysis to form dimensionless numbers in terms of input output variables. |
| CO5 | Understand the basic concept of compressible flow and CFD |
| CO6 | Conduct basic experiments of fluid mechanics and understand the experimental uncertainties. |
| **Course Code** | **BME404 - MECHANICAL MEASUREMENTS AND METROLOGY LAB** |
| CO1 | To calibrate pressure gauge, thermocouple, LVDT, load cell, micrometer. |
| CO2 | To measure angle using Sine Center/ Sine Bar/ Bevel Protractor, alignment using Autocollimator/ Roller set. |

| CO3 | To demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats. |
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| CO4 | To measure cutting tool forces using Lathe/Drill tool dynamometer. |
| CO5 | To measure Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth vernier/Gear tooth micrometer. |
| CO6 | To measure surface roughness using Tally Surf/ Mechanical Comparator. |
| **Course Code** | **BME405A - NON TRADITIONAL MACHINING** |
| CO1 | Describe non-traditional machining process and compare with Traditional machining process. Recognize the need for Non-traditional machining process. |
| CO2 | Describe the constructional features, performance parameters, process characteristics, applications, advantages, and limitations of USM, AJM and WJM. |
| CO3 | Characterize the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages, and limitations. |
| CO4 | Illustrate the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM |
| **Course Code** | **BME405B - ENVIRONMENTAL STUDIES** |
| CO1 | Understand the basic concepts of environmental studies and natural resources. |
| CO2 | Explain about the various eco-systems of nature. |
| CO3 | Discuss different types of environmental pollutions and their control measures. |
| CO4 | Explain the acquired knowledge about the various social aspects related to the environment. |
| **Course Code** | **BME405C - MEMS-Micro Electro Mechanical Systems** |
| CO1 | Understand the working of MEMS technology & Miniaturization. |
| CO2 | Explain the Process of Micro fabrication Techniques. |
| CO3 | Explain the principles of system modelling. |
| CO4 | Understand the working principles of Mechanical sensors and actuators. |
| CO5 | Describe the working principles of Micro-Opto-Electro Mechanical Systems |

| Course Code | BME405D - ROBOTICS AND AUTOMATION |
|---|---|
| CO1 | Explain various types of Robotics, automation, robotics motion, sensors and control, machine vision, robotic programming and roles of robots in industry. |
| CO2 | Understand the working methodology of robotics and automation, motion and control, machine vision and programming, application of robots in industry. |
| CO3 | Write the program for robot for various applications. |
| CO4 | Describe the different material handling and Identification technologies used in automation |

| Course Code | BME456A - INTRODUCTION TO AI & ML |
|---|---|
| CO1 | Understand the implementation procedures for the machine learning algorithms |
| CO2 | Design Java/Python programs for various Learning algorithms. |
| CO3 | Apply appropriate data sets to the Machine Learning algorithms |
| CO4 | Identify and apply Machine Learning algorithms to solve real world problems |
| CO5 | Examine working of PDF and word file formats |

| Course Code | BME456B - Digital Marketing |
|---|---|

| Course Code | BME456C  - INTRODUCTION TO DATA ANALYTICS |
|---|---|
| CO1 | Analyze data using tools and represent for visualization |
| CO2 | Implement various statistical methods. |
| CO3 | Understand and use decision tree and random forest algorithm |
| CO4 | Understand and Implement T test and Anova |

| Course Code | BME456D - Introduction to programming in C++ |
|---|---|
| CO1 | Apply Object Oriented Programming concepts in C++ |
| CO2 | Write a C++ program by applying knowledge of mathematics, science, and engineering. |
| CO3 | Function on multi-disciplinary teams. |
| CO4 | Identify, formulate, and solve engineering problems. |

| | M.TECH - THERMAL POWER ENGINEERING (2022 SCHEME) |
|---|---|
| **Course Code** | **22MTP11- Applied Mathematics** |
| CO1 | Acquire the idea of significant figures, types of errors during numerical computation |
| CO2 | Develop the mathematical models of thermal system using ODE's and PDE's. |
| CO3 | Learn the deterministic approach for statistical problems by using probability distributions |
| CO4 | Classify and analyze mathematical tools applied to thermal engineering study cases. |
| **Course Code** | **22MTP12- Theory and Design of Modern IC Engine** |
| CO1 | To explore the knowledge of performance parameters and its characteristics, variables effect the performance of engine and methods of improving engine performance of internal combustion engine. |
| CO2 | Analyze combustion and apply remedial measures to avoid abnormal combustion in SI and CI Engine |
| CO3 | Analyze different electronic fuel injection system, supercharging and its effect on performance of SI and CI engine. |
| CO4 | Apply various emission control system and modification to take corrective actions to reduce pollution |
| **Course Code** | **22MTP13- Advanced Fluid Mechanics** |
| CO1 | Illustrate the basic concepts fluid flow and their governing equations |
| CO2 | Analyse the laminar and turbulent flow problems. |
| CO3 | Demonstrate the concept of boundary layer equations and drag and lift force |
| CO4 | Distinguish normal and oblique shocks and their governing Equations. |
| CO5 | Explain thePropagation of sound waves and Comparison of isentropic and adiabatic processes in fluid mechanics. |
| **Course Code** | **22MTP14- Advanced Thermodynamics and Combustion** |
| CO1 | Illustrate the basic concepts on First & Second Law Analysis,entropy, and exergy analysis in thermodynamic systems. |

| CO2 | Analyse the Thermodynamic property relations and its application to gas mixtures, phase change processes. |
|------|------|
| CO3 | Demonstrate the Combustion fundamentals involving premixed and nonpremixed flames for laminar and turbulent combustion. |
| CO4 | Explain the fundamental of properties of gas mixtures, chemical reactions, and chemistry of combustion. |
| CO5 | Applications of Combustion phenomena in practical occurring applications such IC and GT engines. |
| **Course Code** | **22MTP15- Finite Element Method in Heat Transfer** |
| CO1 | Recall Governing Equations for Heat Conduction for solving 1-D thermal problems using Approximate methods, Rayleigh – Ritz Methods and Galerkin's methods. |
| CO2 | Formulate the element characteristic for linear and Quadratic matrices and vectors for1-D and 2-D problems. |
| CO3 | Explain the Formulation of Heat Conduction Equations for 1D, 3-D, Fin, and Nonlinear Heat conduction for developing mathematical models |
| CO4 | Demonstrate the Application of numerical methods on heat transfer problems, Convective Heat Transfer and Fluid Mechanics Problems. |
| **Course Code** | **22RMI16- Research Methodology and IPR** |
| CO1 | Discuss research methodology and the technique of defining a research problem |
| CO2 | Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review. |
| CO3 | Explain various research designs, sampling designs, measurement and scaling techniques and different methods of data collections. |
| CO4 | Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports |
| CO5 | Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR |
| **Course Code** | **22MTPL17 - FEM & Simulation Lab** |
| CO1 | Develop skills in making geometry and meshing for various configurations using ANSYS Workbench. |
| CO2 | Develop knowledge in CFD simulation of Convective heat transfer and phase change problems using ANSYS Workbench. |

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| CO3 | Develop knowledge in simulation of lamina and turbulent flow using ANSYS Workbench. |
| CO4 | Develop MATLAB programme for simulation of IC engine performances. |
| **Course Code** | **22MTP21- Advanced Power Plant Cycles** |
| CO1 | Describe the power generation scenario, the layout components of thermal power plant and analyze the improved Rankin cycle, Cogeneration cycle. |
| CO2 | Analyze the steam condensers, recognize the environmental impacts of thermal power plant and method to control the same. |
| CO3 | Recognize the layout, component details of hydroelectric power plant and nuclear power plant |
| CO4 | Describe the different power plant electrical instruments and basic principles of economics of power generation |
| **Course Code** | **22MTP22- Advanced Heat Transfer** |
| CO1 | Ability to understand modes of heat transfer with energy equation and develop models for physical problems and analyze steady state, fins, and transient heat conduction problems of real-life thermal systems |
| CO2 | Identify and explain the concepts of Boundary layers using Laminar and turbulent conditions. |
| CO3 | Understand and recognize the free and forced convection problems in real time applications. |
| CO4 | Apply different methods for solution of radiative heat transfer problems in nonparticipating and participating medium and applications of boiling and condensation in industry |
| CO5 | Demonstrate the importance of heat exchanger and its applications in industry. |
| **Course Code** | **22MTP231- Steam and Gas Turbines** |
| CO1 | Describe the working principles of Gas and steam turbine nozzles and diffusers |
| CO2 | Designate the working principles of impulse and reaction turbines using velocity triangles |
| CO3 | Use the concepts of State Point Locus Reheat Factor and Identify the various losses associated with the turbines. |
| CO4 | Illustrate the concepts of axial flow and centrifugal compressors and its application in gas turbine. |
| CO5 | Explain the concepts of open and closed cycle gas turbine and its application in jet propulsion. |

| Course Code | 22MTP232- Renewable Energy Technology |
|---|---|
| CO1 | Describe measurement of direct, diffuse, and global solar radiations falling on horizontal and inclined surfaces, Basic earth sun angles, Beam and diffuse radiations, Radiation on titled surfaces. |
| CO2 | Analyze the performance by conducting research on flat plate collector, air heater and concentrating type collector. Understand test procedures and apply these while testing different types of collectors. |
| CO3 | Demonstrate and Design various types of thermal energy storage systems. Analyze payback period and annual solar savings due to replacement of conventional systems |
| CO4 | Demonstrate the importance of solar energy effectively to increase awareness of it in society. |
| CO5 | Describe measurement of direct, diffuse, and global solar radiations falling on horizontal and inclined surfaces, Basic earth sun angles, Beam and diffuse radiations, Radiation on titled surfaces. |
| Course Code | 22MTP233- Design and Optimization of Thermal Energy Systems |
| CO1 | Formulation of design problems related to thermal Systems. |
| CO2 | Apply methods of optimization to solve a linear, non-linear programming problem by various methods. |
| CO3 | Optimize engineering problem of nonlinear programming with/without constraints, by using this technique |
| CO4 | Use of dynamic programming problem in controlling in industrial managements. |
| CO5 | Simulate Thermal engineering system problem. Understand integer programming and stochastic programming to evaluate advanced optimization techniques. |
| Course Code | 22MTP234- Cryogenics |
| CO1 | Understand the working principles and applications of different types of gas liquefaction and refrigeration systems. |
| CO2 | Understanding the governing laws and principles of gas separation |
| CO3 | Illustrate Ideal separation, properties of mixtures, Rectifiers column, separation of air, purification. |
| CO4 | Understanding the importance of cryogenics insulations and Safety in Cryogenics. |
| CO5 | Study and describe Insulation and storage systems in cryogenic engineering |
| Course Code | 22MTP235- Nuclear Engineering in Power Generation |

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|---|---|
| CO1 | Understand the basic physics of nuclear reactions |
| CO2 | Basic concepts of nuclear fuel manufacturing and spent fuel handling |
| CO3 | Classification of nuclear reactors |
| CO4 | Understand working principle of thermal reactor |
| CO5 | Analyse the thermal hydraulics of nuclear reactors |
| **Course Code** | **22MTP241 - Refrigeration and Air Conditioning** |
| CO1 | Understand concepts of refrigeration and air-conditioning process and systems. |
| CO2 | Employ the theoretical principles to simple, complex vapour compression and vapour absorption refrigeration systems. |
| CO3 | Understand conventional and alternate refrigerants and their impact on environment. |
| CO4 | Apply the heat load calculation to design the air-conditioning systems. |
| CO5 | Describe the concepts to design air distribution systems. |
| **Course Code** | **22MTP242 - Hydrogen and Fuel Cell Technologies** |
| CO1 | Apply know-how of thermodynamics, electrochemistry, heat transfer, and fluid mechanics principles to design and analysis of this emerging technology. |
| CO2 | Have thorough understanding of performance behaviour, operational issues and challenges for all major types of fuel cells. |
| CO3 | Identify, formulate, and solve problems related to fuel cell technology keeping in mind economic viability. |
| CO4 | Use the techniques, skills, and modern engineering tools necessary for design and analysis of innovative fuel cell systems. |
| CO5 | Understand the impact of this technology in a global and societal context. Develop enough skills to design systems or components of fuel cells. |
| **Course Code** | **22MTP243 - Jet and Rocket Propulsion systems** |
| CO1 | Understand the aero thermo chemistry of the combustion products |

| CO2 | Apply knowledge of features and capabilities of chemical and non-chemical rocket propulsion systems. |
|---|---|
| CO3 | Apply the concepts to ramjet ant jet propulsion system. |
| CO4 | Calculate the specific impulse and mass flow for a rocket engine with the fluid considered as an ideal gas with constant specific heats. |
| CO5 | Estimate the specific impulse and mass flow for a rocket engine accounting for chemical reaction and non-constant specific heats. |
| **Course Code** | **22MTP244 - Computational Methods in Heat Transfer and Fluid Flow** |
| CO1 | To derive the stepwise procedure to completely solve a fluid dynamics problem using computational methods. |
| CO2 | To explain the governing equations and understand the behaviour of the equations. |
| CO3 | To determine the consistency, stability, and convergence of various discretization schemes for parabolic, elliptic and hyperbolic partial differential equations. |
| CO4 | To verify variations of SIMPLE schemes for incompressible flows and Variations of Flux Splitting algorithms for compressible flows. |
| CO5 | To identify various methods of grid generation techniques and application of finite difference and finite volume methods to various thermal problems. |
| **Course Code** | **22MTP245 - Energy Conservation and Management** |
| CO1 | Understand the various energy conservation and improvement techniques |
| CO2 | Illustrate the Energy scenario. |
| CO3 | Employ the principles of thermal engineering and energy management to improve the Performance of thermal systems. |
| CO4 | Assess energy projects based on economic and financial criteria. |
| CO5 | Describe methods of energy production for improved utilization. |
| **Course Code** | **22MTP225 - MINI PROJECT WITH SEMINAR** |
| CO1 | Present the mini-project and be able to defend it |
| CO2 | Make links across different areas of knowledge and to generate, develop and evaluate ideas and information to |

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| | apply these skills to the project task. |
| CO3 | Habituated to critical thinking and use problem solving skills |
| CO4 | Communicate effectively and to present ideas clearly and coherently in both the written and oral forms |
| CO5 | Work in a team to achieve common goal. |
| CO6 | Learn on their own, reflect on their learning and take appropriate actions to improve it. |
| **Course Code** | **22MTPL26 - CFD and Numerical Lab** |
| CO1 | Develop knowledge in coding to simulate the flow in a Lid driven cavity |
| CO2 | Develop skills in coding for natural convection heat transfer in enclosures. |
| CO3 | Develop skills in making geometry and meshing for various configurations using ANSYS Workbench. |
| CO4 | Develop knowledge in CFD simulation of Convective heat transfer and phase change problems using ANSYS Workbench. |
| CO5 | Develop knowledge in simulation of turbulent flow using ANSYS Workbench. |
| **Course Code** | **22MTP31 - Design of Heat Transfer Equipment's** |
| CO1 | Understand the physics and the mathematical treatment of typical heat exchangers and employ LMTD and Effectiveness methods in the design of heat exchangers |
| CO2 | Design, analyze and examine the performance of double-pipe counter flow (hair-pin) and shell and tube heat exchanger |
| CO3 | Understand the fundamental, physical and mathematical aspects of and condensation. |
| CO4 | Demonstrate the importance of Vaporizers, Evaporators and Reboilers as heat exchangers |
| CO5 | Classify cooling towers and explain their technical features. |
| **Course Code** | **22MTP32 - Alternative Fuels for IC Engines** |
| CO1 | Explain about the availability and usage of conventional fuels for IC engines |
| CO2 | Identify possible alternative fuels for IC engines. |

| CO3 | Demonstrate the use of alternative fuels for different types of engines |
|---|---|
| CO4 | Assess the environmental impact standards and procedures of using alternate fuels. |
| CO5 | Describe and analyze Need for alternative fuels such as Ethanol, Methanol, LPG, CNG, Hydrogen and their manufacturing procedure. |
| **Course Code** | **22MTP322 - Thermal Power Station** |
| CO1 | Describe the working principle, operation, and maintenance of a various steam generators. |
| CO2 | Identify the arrangements of different flow systems their operation and maintenance. |
| CO3 | Illustrate the impact of thermal power plant exhaust on environment |
| CO4 | Estimate the working expenses, current scenario and trends in power generation. |
| CO5 | Asses the performance and suitability of thermal power plant. |
| **Course Code** | **22MTP323 - Convective Heat and Mass Transfer** |
| CO1 | Understand the fundamental and advanced principles of forced and natural convection heat transfer processes. |
| CO2 | Formulate and solve convective heat transfer problems |
| CO3 | Relate the principles of convective heat transfer to estimate the heat dissipation from devices. |
| CO4 | Estimate the energy requirements for operating a flow system with heat transfer. |
| CO5 | Relate to the current challenges in the field of convective heat transfer. |
| **Course Code** | **22MTP324 - Gas Dynamics** |
| CO1 | Apply continuity, momentum, and energy equations to compressible flows. |
| CO2 | Analyze isentropic and non-isentropic flows across normal shock waves. |
| CO3 | Solve compressible flow problems involving heat transfer and friction. |
| CO4 | Apply conservation laws to fluid flow problems and gain knowledge about main properties which are used for analyzing or modelling of compressible flow |

| CO5 | Solve flow problems with heat addition and with friction and Simulation of One-dimensional flow in Shock tube. |
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| **Course Code** | **22MTP325 - Measurement Systems in Thermal Engineering** |
| CO1 | Understand the concepts of errors in measurements, statistical analysis of data, regression analysis, correlation, and estimation of uncertainty. |
| CO2 | Describe the working principles in the measurement of field and derived quantities. |
| CO3 | Examine sensing requirements for measurement of thermo-physical properties, radiation properties of surfaces, and vibration |
| CO4 | Understand conceptual development of zero, first and second order systems |
| CO5 | Interpret International Standards of measurements (ITS-90) and identify internationally accepted measuring standards for measurands. |
| **Course Code** | **22MTP331 - Theory of IC Engines** |
| CO1 | Understand the concepts of errors in measurements, statistical analysis of data, regression analysis, correlation, and estimation of uncertainty. |
| CO2 | Describe the working principles in the measurement of field and derived quantities. |
| CO3 | Examine sensing requirements for measurement of thermo-physical properties, radiation properties of surfaces, and vibration. |
| CO4 | Understand conceptual development of zero, first and second order systems |
| CO5 | Interpret International Standards of measurements (ITS-90) and identify internationally accepted measuring standards for measurands. |
| **Course Code** | **22MTP332 - Environmental Engineering and Pollution Control** |
| CO1 | Grasp the fundamentals of air pollution and its associated environmental impacts. |
| CO2 | Earn to describe the key concepts of air quality management. |
| CO3 | Do sampling and characterization of solid waste and analysis of hazardous waste constituents including QA/QC issues |
| CO4 | Apply steps in solid waste management-waste reduction at source, collection techniques, materials and resource recovery/recycling, transport, optimization of solid waste transport, treatment and disposal techniques. |

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| CO5 | Schemes, incentives, policies on industrial waste management and Overview of product design for waste minimization. |
| **Course Code** | **22MTP333 -** Safety in Engineering Industry |
| **CO1** | **Describe the theories of accident causation and preventive measures of industrial accidents.** |
| CO2 | Explain about personal protective equipment, its selection, safety performance & indicators and importance of housekeeping. |
| CO3 | Explain different issues in construction industries. |
| CO4 | Describe various hazards associated with different machines and mechanical material handling. |
| CO5 | Utilise different hazard identification tools in different industries with the knowledge of different types of chemical hazards. |
| **Course Code** | **22MTP334 - Biomass Energy Conversion Techniques** |
| CO1 | Develop knowledge in properties of biomass and energy conversion process |
| CO2 | Compare the characteristics of products obtained from biomass pyrolysis. |
| CO3 | Understand the basics of biomass gasification and gasifier design. |
| CO4 | Assess the potential of electrical power production from biomass. |
| **Course Code** | **22MTP335 - Non-Conventional Energy Sources** |
| CO1 | Demonstrate the generation of electricity from various Non-Conventional sources of energy, have a working knowledge on types of fuel cells. |
| CO2 | Estimate the solar energy, Utilization of it, Principles involved in solar energy collection and conversion of it to electricity generation. |
| CO3 | Explore the concepts involved in wind energy conversion system by studying its components, types and performance. |
| CO4 | Illustrate ocean energy and explain the operational methods of their utilization. |
| CO5 | Acquire the knowledge on Geothermal energy. |

| Course Code | 22MTP34 - PROJECT WORK PHASE – 1 |
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| CO1 | Demonstrate a sound technical knowledge of their selected project topic. |
| CO2 | Undertake problem identification, formulation, and solution. |
| CO3 | Design engineering solutions to complex problems utilising a systems approach |
| CO4 | Communicate with engineers and the community at large in written an oral forms. |
| CO5 | Demonstrate the knowledge, skills and attitudes of a professional engineer. |

| Course Code | 22MTPI36 - INTERNSHIP |
|---|---|
| CO1 | Gain practical experience within industry in which the internship is done. |
| CO2 | Acquire knowledge of the industry in which the internship is done. |
| CO3 | Apply knowledge and skills learned to classroom work. |
| CO4 | Develop a greater understanding about career options while more clearly defining personal career goals. |
| CO5 | Experience the activities and functions of professionals |
| CO6 | Develop and refine oral and written communication skills |
| CO7 | Identify areas for future knowledge and skill development. |
| CO8 | Expand intellectual capacity, credibility, judgment, intuition. |
| CO9 | Acquire the knowledge of administration, marketing, finance and economics. |

| Course Code | 22MTP41 - PROJECT WORK PHASE -2 |
|---|---|
| CO1 | To support independent learning |
| CO2 | To guide to select and utilize adequate information from varied resources maintaining ethics. |
| CO3 | To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly |
| CO4 | To develop interactive, communication, organisation, time management, and presentation skills. |

| CO5 | To impart flexibility and adaptability. |
|------|------|
| CO6 | To inspire independent and team working. |
| CO7 | To expand intellectual capacity, credibility, judgement, intuition. |
| CO8 | To adhere to punctuality, setting and meeting deadlines. |
| CO9 | To instill responsibilities to oneself and others. |
| CO10 | To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. |

| | MECHANICAL ENGINEERING ( 2021 SCHEME) |
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| **Course Code** | **21EVN15/25 - Engineering Visualisation** |
| CO1 | Understand and visualize the objects with definite shape and dimensions |
| CO2 | Analyze the shape and size of objects through different views |
| CO3 | Develop the lateral surfaces of the object |
| CO4 | Create a 3D view using CAD software |
| CO5 | Identify the interdisciplinary engineering components or systems through its graphical representation. |
| **Course Code** | **21ME15/25-ELEMENTS OF MECHANICAL ENGINEERING** |
| CO1 | Understand basic concepts of mechanical engineering in the fields of energy and its utilization, materials technology, manufacturing techniques, and transmission |
| CO2 | Understand the application of energy sources in Power generation and utilization, Engineering materials, manufacturing, and machining techniques leading to the latest |
| CO3 | Apply the skills in developing simple mechanical elements and processes |
| **Course Code** | **21IDT19/29 - INNOVATION and DESIGN THINKING** |
| CO1 | Appreciate various design process procedure |
| CO2 | Generate and develop design ideas through different technique |
| CO3 | Identify the significance of reverse Engineering to Understand products |
| CO4 | Draw technical drawing for design ideas |
| **Course Code** | **21MAT 31 TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES** |
| CO1 | To solve ordinary differential equations using Laplace transform. |
| CO2 | Demonstrate the Fourier series To study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory. |
| CO3 | To use Fourier transforms To analyze problems involving continuous-time signals and To apply Z-Transform techniques To solve difference equations |
| CO4 | To solve mathematical models represented by initial or boundary value problems involving partial differential equations |

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| CO5 | Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis. |
| **Course Code** | **21ME32 - METAL CASTING FORMING & JOINING PROCESS (IPCC)** |
| CO1 | Select appropriate primary manufacturing process and related parameters for obtaining initial shape and size of components. |
| CO2 | Design and develop adequate Tooling linked with casting, welding and forming operations. |
| CO3 | Appreciate the effect of process parameters on quality of manufactured components |
| CO4 | Demonstrate various skills in preparation of molding sand for conducting tensile, shear and compression tests using Universal sand testing machine. |
| CO5 | Demonstrate skills in preparation of forging models involving upsetting, drawing and bending operations. |
| CO6 | Demonstrate skills in preparation of Welding models. |
| **Course Code** | **21ME33 - MATERIAL SCIENCE AND ENGINEERING (IPCC)** |
| CO1 | Understand the aTomic arrangement in crystalline materials and describe the periodic arrangement of aToms in terms of |
| CO2 | Understand the importance of phase diagrams and the phase transformations. |
| CO3 | Know various heat treatment methods for controlling the microstructure.. |
| CO4 | Correlate between material properties with component design and identify various kinds of defects. |
| CO5 | Apply the method of materials selection, material data and knowledge sources for computer-aided selection of materials. |
| **Course Code** | **21ME34 - THERMODYNAMICS** |
| CO1 | Describe the fundamental concepts and principles of engineering thermodynamics. |
| CO2 | Apply the governing laws of thermodynamics for different engineering applications. |
| CO3 | Analyse the various thermodynamic processes, cycles and results. |
| CO4 | Interpret and relate the impact of thermal engineering practices To real life problems. |
| **Course Code** | **21MEL35 - MACHINE DRAWING AND GD & T** |
| CO1 | Interpret the Machining and surface finish symbols on the component drawings. |
| CO2 | Apply limits and Tolerances To assemblies and choose appropriate fits for given assemblies. |
| CO3 | Illustrate various machine components through drawings |
| CO4 | Create assembly drawings as per the conventions. |

| Course Code | 21ME381 - INTRODUCTION To PYTHON |
|---|---|
| CO1 | Demonstrate proficiency in handling of loops and creation of functions. |
| CO2 | Identify the methods To create and manipulate lists, tuples and dictionaries. |
| CO3 | Discover the commonly used operations involving regular expressions and file system. |
| CO4 | Examine working of PDF and word file formats |

| Course Code | 21ME382 - INTRODUCTION To VIRTUAL REALITY |
|---|---|
| CO1 | Describe how VR systems work and list the applications of VR. |
| CO2 | Understand the design and implementation of the hardware that enables VR systems To be built. |
| CO3 | Understand the system of human vision and its implication on perception and rendering. |
| CO4 | Explain the concepts of motion and tracking in VR systems. |
| CO5 | Describe the importance of interaction and audio in VR systems. |

| Course Code | 21ME383 - DIGITAL SOCIETY |
|---|---|
| CO1 | Identify the ways in which digital media shape identity |
| CO2 | Utilize new opportunities for meaningful data collection from and using sophisticated forms of artificial intelligence |
| CO3 | Identify knowledge and truth amongst the abundance of information |

| Course Code | 21MATME41 - COMPLEX ANALYSIS, PROBABILITY AND LINEAR PROGRAMMING |
|---|---|
| CO1 | Use the concepts of an analytic function and complex potentials To solve the problems arising in fluid flow. |
| CO2 | Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image |
| CO3 | Apply discrete and continuous probability distributions in analyzing the probability models arising in the engineering |
| CO4 | Analyze and solve linear programming models of real-life situations and solve LPP by the simplex method |
| CO5 | Learn techniques To solve Transportation and Assignment problems. |

| Course Code | 21ME42 - MACHINING SCIENCE AND JIGS & FIXTURES (IPCC) |
|---|---|
| CO1 | Demonstrate the Conventional CNC machines and advanced manufacturing process operations |
| CO2 | Determine Tool life, cutting force, and economy of the machining process. |
| CO3 | Analyze the influence of various parameters on machine Tools' performance. |
| CO4 | Select the appropriate machine Tools and process, the Jigs, and fixtures for various applications. |

| Course Code | 21ME43 - FLUID MECHANICS (IPCC) |
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| CO1 | Understand the basic principles of fluid mechanics and fluid kinematics |

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| CO2 | Acquire the basic knowledge of fluid dynamics and flow measuring instruments |
| CO3 | Understand the nature of flow and flow over bodies and the dimensionless analysis |
| CO4 | Acquire the compressible flow fundamental and basics of CFD packages and the need for CFD analysis. |
| CO5 | Conduct basic experiments of fluid mechanics and understand the experimental uncertainties. |
| **Course Code** | **21ME44 - MECHANICS OF MATERIALS** |
| CO1 | Understand simple, compound, thermal stresses and strains their relations and strain energy. |
| CO2 | Analyse structural members for stresses, strains and deformations. |
| CO3 | Analyse the structural members subjected To bending and shear loads. |
| CO4 | Analyse shafts subjected To twisting loads. |
| CO5 | Analyse the short columns for stability. |
| **Course Code** | **21MEL46 - MECHANICAL MEASUREMENTS AND METROLOGY LABORAToRY** |
| CO1 | Understand Calibration of pressure gauge, thermocouple, LVDT, load cell, micrometer. |
| CO2 | Apply concepts of Measurement of angle |
| CO3 | Demonstrate measurements using Optical ProjecTor/Tool maker microscope, Optical flats. |
| CO4 | Analyse Screw thread parameters using 2-Wire or 3-Wire method, gear Tooth profile using gear Tooth Vernier/Gear |
| CO5 | Understand the concepts of measurement of surface roughness. |
| CO6 | Demonstrate the use of Coordinate Measuring Machine (CMM) / Laser Scanner |
| **Course Code** | **21MT481 - SPREAD SHEETS FOR ENGINEERS** |
| CO1 | To create different plots and charts |
| CO2 | To compute different functions, conditional functions and make regression analysis |
| CO3 | To carryout iterative solutions for roots, multiple roots, optimization and non-linear regression analysis |
| CO4 | To carryout matrix operations |
| CO5 | To Understand VBA and UDF |
| CO6 | To understand VBA subroutines and Macros |
| CO7 | To carryout numerical integration and solving differential equations using different methods |
| **Course Code** | **21ME482 - INTRODUCTION To AI AND ML** |
| CO1 | Understand the basic principles and goals of AI tasks. |
| CO2 | Outline the role of AI in different real-time applications. |
| CO3 | Construct a problem with the suitable AI task. |
| CO4 | Demonstrate the importance of biology in AI. |

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| CO5 | Survey the future development of AI. |
| **Course Code** | **21ME483 - Introduction To Augmented Reality** |
| CO1 | Describe how AR systems work and list the applications of AR. |
| CO2 | Understand and analyse the hardware requirement of AR. |
| CO3 | Use computer vision concepts for AR and describe AR techniques |
| CO4 | Analyse and understand the working of various state of the art AR devices |
| CO5 | Acquire knowledge of mixed reality |
| **Course Code** | **21ME51 - THEORY OF MACHINES** |
| CO1 | Knowledge of mechanisms and their motion and the inversions of mechanisms |
| CO2 | Analyse the velocity, acceleration of links and joints of mechanisms.. |
| CO3 | Analyse the mechanisms for static and dynamic equilibrium. |
| CO4 | Carry out the balancing of rotating and reciprocating masses |
| CO5 | Analyse different types of governors used in real life situation. |
| CO6 | Analyze the free and forced vibration phenomenon. |
| **Course Code** | **21ME52 - THERMO-FLUIDS ENGINEERING (IPCC)** |
| CO1 | Apply the concepts of testing of I. C. Engines and evaluate their performance, and evaluate the performance of |
| CO2 | Apply and analyse the concepts related To Refrigeration and Air conditioning, and get conversant with Psychrometric |
| CO3 | Explain the construction, classification and working principle of the Turbo machines and apply of Euler's turbine equation To evaluate the energy transfer and other related parameters. Compare and evaluate the performance of positive displacement pumps. |
| CO4 | Classify, Explain and analyse the various types of hydraulic turbines and centrifugal pumps. |
| CO5 | Classify, Explain and analyse various types of steam turbines and centrifugal compressor. |
| **Course Code** | **21ME53 - FINITE ELEMENT ANALYSIS** |
| CO1 | Identify the application and characteristics of FEA elements such as bars, beams, plane and isoparametric elements. |
| CO2 | Develop element characteristic equation and generation of global equation. |
| CO3 | Formulate and solve Axi-symmetric and heat transfer problems. |
| CO4 | Apply suitable boundary conditions To a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi-symmetric and dynamic problems. |

| Course Code | 21ME54 - MODERN MOBILITY & AUToMOTIVE MECHANICS |
|---|---|
| CO1 | Understand the working of different systems employed in auTomobile |
| CO2 | Analyse the limitation of present day auTomobiles |
| CO3 | Evaluate the energy sources suitability |
| CO4 | Apply the knowledge for selection of auTomobiles based on their suitability |
| **Course Code** | **21MEL55 - DESIGN LAB** |
| CO1 | Compute the natural frequency of the free and forced vibration of single degree freedom systems, critical speed of shafts. |
| CO2 | Carry out balancing of rotating masses and gyroscope phenomenon. |
| CO3 | Analyse the governor characteristics. |
| CO4 | Determine stresses in disk, beams and plates using phoTo elastic bench. |
| CO5 | Determination of Pressure distribution in Journal bearing |
| CO6 | Analyse the stress and strains using strain gauges in compression and bending test |
| CO7 | To realize different mechanisms and cam motions |
| **Course Code** | **21ME581 - BASICS OF MATLAB** |
| CO1 | Able To implement loops, branching, control instruction and functions in MATLAB programming environment. |
| CO2 | Able To program curve fitting, numerical differentiation and integration, solution of linear equations in MATLAB and |
| CO3 | Able To understand implementation of ODE using ode 45 and execute Solutions of nonlinear equations and DFT in |
| CO4 | Able To simulate MATLAB Simulink examples |
| **Course Code** | **21ME582- DIGITAL MARKETING** |
| CO1 | To identify the importance of the digital marketing for marketing success, |
| CO2 | To manage cusTomer relationships across all digital channels and build better cusTomer relationships |
| CO3 | To create a digital marketing plan, starting from the SWOT analysis and defining a target group, then identifying digital channels, their advantages and limitations, |
| CO4 | To perceive ways of the integration taking inTo consideration the available budget. |

| Course Code | 21ME583 - VFX: VISUAL EFFECTS | |
|---|---|---|
| CO1 | Gain good understanding about compositing process. | |
| CO2 | Identify major applications of compositing process used in industry. | |
| CO3 | Develop a visual effects pipeline. | |
| CO4 | Demonstrate an in-depth knowledge of grading and VFX principles, practice and system capabilities. | |
| CO5 | Create cusTomized Tools through software or scripting To allow for more creative application of visual effects | |
| Course Code | 21ME61 - PRODUCTION AND OPERATIONS MANAGEMENT | |
| CO1 | Apply the necessary Tools for decision making in operations management. | |
| CO2 | Examinevariousapproachesforforecastingthesalesdemandforanorganization. | |
| CO3 | ListvariouscapacityandlocationplansTodeterminethesuitablecapacityrequiredformeetingtheforecastdemandofanorganizati | |
| CO4 | Analyse the aggregate plan and master production schedule for an organization, given its periodic demand. | |
| CO5 | Apply MRP, purchasing and SCM techniques inTo practice. | |
| Course Code | 21ME62 - HEAT TRANSFER (IPCC) | |
| CO1 | Solve steady state heat transfer problems in conduction. | |
| CO2 | Solve transient heat transfer problems | |
| CO3 | solve convection heat transfer problems using correlations | |
| CO4 | Solve radiation heat transfer problems | |
| CO5 | Explain the mechanisms of boiling and condensation. And Determine performance parameters of heat exchangers. | |
| Course Code | 21ME63 - MACHINE DESIGN | |
| CO1 | Apply codes and standards in the design of machine elements and select an element based on the Manufacturer's | |
| CO2 | Analyse the performance and failure modes of mechanical components subjected To combined loading and fatigue | |
| CO3 | Demonstrate the application of engineering design Tools To the design of machine components like shafts, springs, | |
| CO4 | Design different types of gears and simple gear boxes for relevant applications. | |
| CO5 | Apply design concepts of hydrodynamic bearings for different applications and select Anti friction bearings for different applications using the manufacturers, catalogue. | |
| Course Code | 21ME641 - SUPPLY CHAIN MANAGEMENT & INTRODUCTION To SAP | |
| CO1 | Understand the framework and scope of supply chain management. | |

| CO2 | Build and manage a competitive supply chain using strategies, models, techniques and information technology. |
|---|---|
| CO3 | Plan the demand, invenTory and supply and optimize supply chain network. |
| CO4 | Understand the emerging trends and impact of IT on Supply chain. |
| CO5 | Understand the basics of SAP material management system |
| **Course Code** | **21ME642 - MECHATRONICS SYSTEM DESIGN** |
| CO1 | Discuss about Mechatronics design process and select the sensor and ActuaTor for a Mechatronics application |
| CO2 | Explain Modeling and Simulation of mechanical Elements, electrical Elements and fluid systemthe sensors in mechatronics systems and Fault detection techniques in Mechatronics. |
| CO3 | Understand the elements of Data Acquisition and Control System, Convert the data in real time interfacing |
| CO4 | Model the dynamic response of first order and second order systems. |
| **Course Code** | 21ME643 - AUToNOMOUS VEHICLES |
| CO1 | Describe the evolution of AuTomotive Electronics and the operation of ECUs. |
| CO2 | Compare the different type of sensing mechanisms involved in AuTonomous Vehicles. |
| CO3 | Discuss about the use of computer vision and learning algorithms in vehicles. |
| CO4 | Summarize the aspects of connectivity fundamentals existing in a driverless car. |
| CO5 | Identify the different levels of auTomation involved in an AuTonomous Vehicle. |
| CO6 | Outline the various controllers employed in vehicle actuation |
| **Course Code** | **21ME644 - INTERNET OF THINGS (IOT)** |
| CO1 | Explain IoT architecture, interpret the design principles that govern connected devices, summarize the roles of various |
| CO2 | Explain the basics of microcontrollers, outline the architecture of Arduino, develop simple applications using Arduino |
| CO3 | outline the architecture of Raspberry Pi, develop simple applications using Raspberry Pi, select a platform for a particular |
| CO4 | interpret different proTocols and compare them, select which proTocol can be used for a specific application, Utilize the |
| CO4 | select IoT APIs for an application, design and develop a solution for a given application using APIs, test for errors in the |
| **Course Code** | **21ME651 - PROJECT MANAGEMENT** |
| CO1 | Understand the selection, prioritization and initiation of individual projects and strategic role of project management. |
| CO2 | Understand the work breakdown structure by integrating it with organization. |
| CO3 | Understand the scheduling and uncertainty in projects. |
| CO4 | Understand risk management planning using project quality Tools. |

| CO5 | Understand the activities like purchasing, acquisitions, contracting, partnering and collaborations related To performing |
|------|------|
| CO6 | Determine project progress and results through balanced scorecard approach |
| CO7 | Draw the network diagram To calculate the duration of the project and reduce it using crashing. |
| **Course Code** | **21ME652 - RENEWABLE ENERGY POWER PLANTS (OPEN ELECTIVE)** |
| CO1 | Describe the various forms of non-conventional energy resources. |
| CO2 | Apply the fundamental knowledge of mechanical engineering To design various renewable energy systems |
| CO3 | Analyze the implications of renewable energy forms for selecting an appropriate system for a specific application |
| CO4 | Discuss on the environmental aspects and impact of non-conventional energy resources, in comparison with various conventional energy systems, their prospects and limitations. |
| **Course Code** | **21ME653 - MECHATRONICS** |
| CO1 | Illustrate various components of Mechatronics systems. |
| CO2 | Assess various control systems used in auTomation. |
| CO3 | Design and conduct experiments To evaluate the performance of a mechatronics system or component with respect To specifications, as well as To analyse and interpret data. |
| CO4 | Apply the principles of Mechatronics design To product design. |
| CO5 | Function effectively as members of multidisciplinary teams. |
| **Course Code** | **21ME654 - MODERN MOBILITY** |
| CO1 | Understand the working of different systems employed in auTomobile |
| CO2 | Analyse the limitation of present day auTomobiles |
| CO3 | Evaluate the energy sources suitability |
| CO4 | Apply the knowledge for selection of auTomobiles based on their suitability |
| **Course Code** | **21MEL66 - CNC PROGRAMMING AND 3-D PRINTING LAB** |
| CO1 | Students will have knowledge of G-code and M-code for machining operations. |
| CO2 | Students will able To perform CNC programming for turning, drilling, milling and threading operation. |
| CO3 | Students will able To visualize the 3D models using CAD software's |
| CO4 | Students will able To use 3D printing technology |
| CO5 | Students are able To understand robotic programming and FMS |

| Course Code | 21ME71 - AUToMATION AND ROBOTICS (PCC) |
|---|---|
| CO1 | Translate and simulate a real time activity using modern Tools and discuss the Benefits of auTomation. |
| CO2 | Identify suitable auTomation hardware for the given application. |
| CO3 | Recommend appropriate modelling and simulation Tool for the given manufacturing Application. |
| CO4 | Explain the basic principles of Robotic technology, configurations, control and Programming of Robots. |
| CO5 | Explain the basic principles of programming and apply it for typical Pick & place, Loading & unloading and palletizing applications |
| Course Code | 21ME72 -CONTROL ENGINEERING |
| CO1 | Identify the type of control and control actions and develop the mathematical model of the physical systems. |
| CO2 | Estimate the response and error in response of first and second order systems subjected standard input signals. |
| CO3 | Represent the complex physical system using block diagram and signal flow graph and obtain transfer function. |
| CO4 | Analyse a linear feedback control system for stability using Hurwitz criterion, Routh's criterion and root Locus technique in complex domain. |
| CO5 | Analyse the stability of linear feedback control systems in frequency domain using polar plots, Nyquist and Bode plots. |
| Course Code | 21ME731 - ADDITIVE MANUFACTURING |
| CO1 | Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available. |
| CO2 | Demonstrate the knowledge of the broad range of AM processes, devices, capabilities and materials that are available. |
| CO3 | Understand the various software Tools, processes and techniques that enable advanced/additive manufacturing. |
| CO4 | Apply the concepts of additive manufacturing To design and create components that satisfy product development/proTotyping requirements, using advanced/additive manufacturing devices and processes. |
| CO5 | Understand characterization techniques in additive manufacturing. |
| CO6 | Understand the latest trends and business opportunities in additive manufacturing. |
| Course Code | 21ME732 - ToTAL QUALITY MANAGEMENT |

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|---|---|
| CO1 | Explain the various approaches of TQM |
| CO2 | Infer the cusTomer perception of quality |
| CO3 | Analyse cusTomer needs and perceptions To design feedback systems. |
| CO4 | Apply statistical Tools for continuous improvement of systems |
| CO5 | Apply the Tools and technique for effective implementation of TQM. |
| **Course Code** | **21ME733 - REFRIGERATION AND AIR-CONDITIONING** |
| CO1 | Illustrate the principles, nomenclature and applications of refrigeration systems. |
| CO2 | Explain vapour compression refrigeration system and identify methods for performance improvement |
| CO3 | Study the working principles of air, vapour absorption, thermoelectric and steam-jet and thermoacoustic refrigeration systems. |
| CO4 | Estimate the performance of air-conditioning systems using the principles of psychrometry. |
| CO5 | Compute and Interpret cooling and heating loads in an air-conditioning system. |
| CO6 | Identify suitable refrigerant for various refrigerating systems. |
| **Course Code** | **21ME734 - MEMS AND MICROSYSTEM TECHNOLOGY** |
| CO1 | Explain MEMS Technology, Present, Future, and Challenges. |
| CO2 | Explain micro-sensors, micro-actuaTors, their types, and applications. |
| CO3 | Explain fabrication processes for producing micro-sensors and actuaTors. |
| CO4 | Apply Reliability and Failure Analysis Testing. |
| CO5 | Understand the operation of microdevices, microsystems, and their applications. Design the microdevices and microsystems using the MEMS fabrication process. |
| **Course Code** | **21ME735 - DESIGN FOR MANUFACTURING & ASSEMBLY** |
| CO1 | have knowledge on design principles for manufacturability |
| CO2 | have knowledge Influencing facTors on Design. |
| CO3 | have knowledge on Machining consideration while design. |
| CO4 | have knowledge on casting consideration while design. |
| CO5 | have knowledge on environment consideration while design. |
| CO6 | have ability To understand contemporary issues and their impact on design for manufacturing and assembly. |
| **Course Code** | **21ME741 - ADVANCED VIBRATIONS AND CONDITION MONIToRING** |
| CO1 | Identify & classify the vibration systems |

| CO2 | Analyse the vibration parameters through different theoretical methods |
|---|---|
| CO3 | Apply the knowledge of vibration measurement instruments and control system |
| CO4 | Understand the sound generation and propagation arising through vibration |
| **Course Code** | **21ME742 - Theory and Design of IC Engines** |
| CO1 | Understand various types of I.C. Engines, Cycles of operation and Identify fuel metering, fuel supply systems for different types of engines. |
| CO2 | Understand combustion phenomena in SI and CI engines and Analyze the effect of various operating variables on engine performance. |
| CO3 | Evaluate performance Analysis of IC Engine and Justify the suitability for different applications. |
| CO4 | Understand the conventional and non-conventional fuels and effects of emission formation of IC engines, its effects, and the legislation standards |
| **Course Code** | **21ME743-ADVANCED TURBOMACHINES** |
| CO1 | Explain the various thermodynamic processes involved in turbomachines with the application of 1st and 2nd law of Thermodynamics and also apply of the concept of law of conservation of energy for the flow through nozzle and diffuser. |
| CO2 | Demonstrate the concept of two-dimensional cascading and evaluating the cascade performance in compressor and turbines. |
| CO3 | Explain the thermodynamics of axial flow turbines and analyse its performance and characteristics. |
| CO4 | Explain the thermodynamics of axial flow compressor and fans and analyse its performance and characteristics. |
| CO5 | Explain and apply the various vortex flow concepts for designing the blades and describe the process of control and maintenance aspects of turbomachines. |
| **Course Code** | **21ME744-PRODUCT DESIGN & ERGONOMICS** |
| CO1 | To learn the concept of product design and the ergonomics. |
| CO2 | Design the various controls and displays by knowing the anthropometric data's. |
| CO3 | To learn the psychology of visuals effects. |
| CO4 | Learning the different colour combinations for optimal design of engineering equipments. |
| CO5 | Realize the importance of environmental facTors and aesthetics in industrial design. |

| Course Code | 21ME751-NON-TRADITIONAL MACHINING |
|---|---|
| CO1 | Understand the compare traditional and non-traditional machining process and recognize the need for Non- traditional machining process. |
| CO2 | Understand the constructional features, performance parameters, process characteristics, applications, advantages and limitations of USM, AJM and WJM. |
| CO3 | Identify the need of Chemical and electro-chemical machining process along with the constructional features, process parameters, process characteristics, applications, advantages and limitations. |
| CO4 | Understand the constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations EDM & PAM. |
| CO5 | Understand the LBM equipment, LBM parameters, and characteristics. EBM equipment and mechanism of metal removal, applications, advantages and limitations LBM & EBM. |
| Course Code | 21ME752-HYDRAULICS AND PNEUMATICS |
| CO1 | Have knowledge of hydraulic and pneumatic system and its components. |
| CO2 | Understand the working principle of various hydraulic and pneumatic components. |
| CO3 | Apply working principles of Hydraulic and Pneumatic Systems for various applications. |
| CO4 | Determine cause for hydraulic and pneumatic system break down and performance of hydraulic pumps, moTors. |
| Course Code | 21ME753-OPERATIONS RESEARCH |
| CO1 | Understand the meaning, definitions, scope, need, phases and techniques of operations research. |
| CO2 | Formulate as L.P.P and derive optimal solutions To linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method. |
| CO3 | Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment and travelling salesman problems. |
| CO4 | Solve problems on game theory for pure and mixed strategy under competitive environment. |
| CO5 | Solve waiting line problems for M/M/1 and M/M/K queuing models. |
| CO6 | Construct network diagrams and determine critical path, floats for deterministic and PERT networks including crashing of Networks |

| | DEPARTMENT OF PHYSICS |
|---|---|
| | **2022 Scheme** |
| **Course Code** | **BPHYC102/202 – APPLIED PHYSICS FOR CV STREAM** |
| CO1 | To understand the types of oscillation, shock waves & its generation, and applications. |
| CO2 | To Study the elastic properties of materials and failures of engineering materials |
| CO3 | To Study the acoustics buildings and the essentials of radiometry and photometry. |
| CO4 | To understand the principles photonic devices and their application relevant to civil engineering. |
| CO5 | To understand the various natural disaster and safety. |
| **Course Code** | **BPHYS102/202 – APPLIED PHYSICS FOR CSE STREAM** |
| CO1 | Describe the principles of LASERS and Optical fibers and their relevant applications. |
| CO2 | Discuss the basic principles of the Quantum Mechanics and its application in Quantum Computing. |
| CO3 | Summarize the essential properties of superconductors and its applications in qubits. |
| CO4 | Illustrate the application of physics in design and data analysis. |
| CO5 | Practice working in groups to conduct experiments in physics and perform precise andhonest measurements. |
| **Course Code** | **BPHYE102/202 - APPLIED PHYSICS FOR EEE STREAM** |
| CO1 | Describe the fundamental principles of the Quantum Mechanics and the essentials of Photonics. |
| CO2 | Elucidate the concepts of conductors, dielectrics and superconductivity. |
| CO3 | Discuss the fundamentals of vector calculus and their applications in Maxwell's Equations and EM Waves. |
| CO4 | Summarize the properties of semiconductors and the working principles of semiconductor devices. |
| CO5 | Practice working in groups to conduct experiments in physics and Perform precise and honest |
| **Course Code** | **BPHYM102/202 - APPLIED PHYSICS FOR ME STREAM** |
| CO1 | Elucidate the concepts in oscillations, waves, elasticity and material failures. |
| CO2 | Discuss the fundamentals of Thermoelectric materials and their application |
| CO3 | Summarize the low temperature phenomena and generation of low temperature. |
| CO4 | Explain the various material characterization techniques. |
| CO5 | Practice working in groups to conduct experiments in physics and perform precise and honest measurements. |

| DEPARTMENT OF CHEMISTRY |  |
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| **2022 Scheme** |  |
| **Course Code** | **BCHEC102/202 – APPLIED CHEMISTRY FOR CIVIL ENGINEERING STREAM** |
| **CO1** | Identify the terms and applications processes involved in scientific and engineeringapplications |
| **CO2** | Explain the phenomena of chemistry to describe the methods of engineering |
| **CO3** | Solve for the problems in chemistry that are pertinent in engineering applications |
| **CO4** | Apply the basic concepts of chemistry to explain the chemical properties and processes |
| **CO5** | Analyze properties and processes associated with chemical substances in multi disciplinary situations. |
| **Course Code** | **BCHES102/202 – APPLIED CHEMISTRY FOR CS ENGINEERING STREAM** |
| **CO1** | Identify the terms and applications processes involved in scientific and engineeringapplications |
| **CO2** | Explain the phenomena of chemistry to describe the methods of engineering processes |
| **CO3** | Solve the problems in chemistry that are pertinent in engineering applications |
| **CO4** | Apply the basic concepts of chemistry to explain the chemical properties and processes |
| **CO5** | Analyze properties and processes associated with chemical substances in multi-disciplinary situations. |
| **Course Code** | **BCHEE102/202 – APPLIED CHEMISTRY FOR EE AND EC ENGINEERING STREAM** |
| **CO1** | Identify the terms and applications processes involved in scientific and engineering |
| **CO2** | Explain the phenomena of chemistry to describe the methods of engineering processes |
| **CO3** | . Solve the problems in chemistry that are pertinent in engineering applications |
| **CO4** | Apply the basic concepts of chemistry to explain the chemical properties and processes |
| **CO5** | Analyze properties and processes associated with chemical substances in multi Disciplinary situations. |
| **Course Code** | **BCHEM102/202 – APPLIED CHEMISTRY FOR MECHANICAL ENGINEERING STREAM** |
| **CO1** | Identify the terms and applications processes involved in scientific and engineeringapplications |
| **CO2** | Explain the phenomena of chemistry to describe the methods of engineering processes |
| **CO3** | Solve the problems in chemistry that are pertinent in engineering applications |
| **CO4** | Apply the basic concepts of chemistry to explain the chemical properties and processes |
| **CO5** | Analyze properties and processes associated with chemical substances in multi-disciplinary Situations. |

| DEPARTMENT OF MATHEMATICS |
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| **2022 Scheme** |

| I SEMESTER |
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| Course Code | **BMATC101 – MATHEMATICS-I (CIVIL STREAM)** |
|---|---|
| **CO1** | Apply the knowledge of calculus to solve problems related to polar curves. |
| **CO2** | Learn the notion of partial differentiation to compute rate of change of multivariate functions. |
| **CO3** | Analyze the solution of linear and nonlinear ordinary differential equations |
| **CO4** | Make use of matrix theory for solving for system of linear equations and compute Eigen values and eigenvectors |
| **CO5** | Familiarize with modern mathematical tools namely MATHEMATICA/ MATLAB/ PYTHON/SCILAB. |
| **Course Code** | **BMATS101– MATHEMATICS -I (CSE STREAM)** |
| **CO1** | Apply the knowledge of calculus to solve problems related to polar curves and learn the notion of partial differentiation to compute rate of change of multivariate functions |
| **CO2** | Analyze the solution of linear and nonlinear ordinary differential equations |
| **CO3** | Get acquainted and to apply modular arithmetic to computer algorithms. |
| **CO4** | Make use of matrix theory for solving for system of linear equations and compute Eigen values and eigenvectors |
| **CO5** | Familiarize with modern mathematical tools namely MATHEMATICA/MATLAB/ PYTHON/ SCILAB |
| **Course Code** | **BMATE101 – MATHEMATICS-I (EC & EEE STREAM)** |
| **CO1** | Apply the knowledge of calculus to solve problems related to polar curves and learn the notion of partial differentiation to compute rate of change of multivariate functions |
| **CO2** | Analyze the solution of linear and nonlinear ordinary differential equations |
| **CO3** | Apply the concept of change of order of integration and variables to evaluate multiple integrals and their usage in computing area and volume |
| **CO4** | : Make use of matrix theory for solving for system of linear equations and compute Eigen values and eigenvectors |
| **CO5** | Familiarize with modern mathematical tools namely MATHEMATICA/ MATLAB/ PYTHON/SCILAB.. |
| **Course Code** | **BMATM101 – MATHEMATICS-I (MECHANICAL STREAM)** |
| **CO1** | Apply the knowledge of calculus to solve problems related to polar curves. |
| **CO2** | Learn the notion of partial differentiation to compute rate of change of multivariate functions. |
| **CO3** | Analyze the solution of linear and non-linear ordinary differential equations. |
| **CO4** | Make use of matrix theory for solving for system of linear equations and compute Eigen values and eigenvectors |
| **CO5** | Familiarize with modern mathematical tools namely MATHEMATICA/ MATLAB/ PYTHON/SCILAB |

| II SEMESTER | |
|---|---|
| **Course Code** | **BMATC201 – MATHEMATICS - II FOR CIVIL STREAM** |
| **CO1** | Apply the knowledge of multiple integrals to compute area and volume |
| **CO2** | Understand the applications of vector calculus refer to solenoidal, irrotational vectors, line integral and surface integral. |
| **CO3** | Demonstrate partial differential equations and their solutions for physical interpretations. |
| **CO4** | Apply the knowledge of numerical methods in solving physical and engineering phenomena. |
| **CO5** | Get familiarize with modern mathematical tools namely MATHEMATICA/MATLAB/PYTHON/SCILAB. |
| **Course Code** | **BMATS201 - MATHEMATICS - II FOR CSE STREAM** |
| **CO1** | Apply the concept of change of order of integration and variables to evaluate multiple integrals and their usage in computing area and volume |
| **CO2** | Understand the applications of vector calculus refer to solenoidal, and irrotational vectors. Orthogonal curvilinear coordinates |
| **CO3** | Demonstrate the idea of Linear dependence and independence of sets in the vector space, and linear transformation |
| **CO4** | Apply the knowledge of numerical methods in analysing the discrete data and solving the physical and engineering problems. |
| **CO5** | Get familiarize with modern mathematical tools namely MATHEMATICA/ MATLAB /PYTHON/ SCILAB. |
| **Course Code** | **BMATE201 - MATHEMATICS - II FOR EC & EEE STREAM** |
| **CO1** | Understand the applications of vector calculus refer to solenoidal, irrotational vectors, Line integral and surface integral |
| **CO2** | Demonstrate the idea of Linear dependence and independence of sets in the vector space, and linear transformation |
| **CO3** | To understand the concept of Laplace transform and to solve initial value problems. |
| **CO4** | Apply the knowledge of numerical methods in solving physical and engineering phenomena |
| **CO5** | Get familiarize with modern mathematical tools namely MATHEMATICA/MATLAB/PYTHON/ SCILAB |
| **Course Code** | **BMATM201 - MATHEMATICS - II FOR MECHANICAL STREAM** |
| **CO1** | Apply the knowledge of multiple integrals to compute area and volume. |
| **CO2** | Understand the applications of vector calculus refer to solenoidal, irrotational vectors, line integral and surface integral. |
| **CO3** | Demonstrate partial differential equations and their solutions for physical interpretations. |
| **CO4** | Apply the knowledge of numerical methods in solving physical and engineering phenomena. |
| **CO5** | Get familiarize with modern mathematical tools namely Mathematics/MatLab/Python/Scilab |
| III SEMESTER | |
| **Course Code** | **BCS301 - MATHEMATICS FOR COMPUTER SCIENCE** |
| **CO1** | Explain the basic concepts of probability, random variables, probability distribution |
| **CO2** | Apply suitable probability distribution models for the given scenario. |

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| **CO3** | Apply the notion of a discrete-time Markov chain and n-step transition probabilities to solve the given problem |
| **CO4** | Use statistical methodology and tools in the engineering problem-solving process. |
| **CO5** | Compute the confidence intervals for the mean of the population. |
| **CO6** | Apply the ANOVA test related to engineering problems. |
| **Course Code** | **BMATEC301 - AV Mathematics-III for EC Engineering** |
| **CO1** | Demonstrate the Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing, and field theory. |
| **CO2** | To use Fourier transforms to analyze problems involving continuous-time signals |
| **CO3** | To apply Z-Transform techniques to solve difference equations |
| **CO4** | Understand that physical systems can be described by differential equations and solve such equations |
| **CO5** | Make use of correlation and regression analysis to fit a suitable mathematical model for statistical data |
| **Course Code** | **BMATE301 - MATHEMATICS-III FOR EE ENGINEERING** |
| **CO1** | Understand that physical systems can be described by differential equations and solve such equations |
| **CO2** | Make use of correlation and regression analysis to fit a suitable mathematical model for statistical data |
| **CO3** | Demonstrate the Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing, and field theory. |
| **CO4** | To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations |
| **CO5** | Apply discrete and continuous probability distributions in analyzing the probability models arising in the engineering field. Demonstrate the validity of testing the hypothesis. |

PRINCIPAL
S.J.M.I.T., Chitradurga.