## GPCET
Pioneering Innovative Education

# G PULLAIAH COLLEGE OF ENGINEERING & TECHNOLOGY
## (Autonomous)

(Approved by AICTE | NAAC Accreditation with 'A' Grade |
Accredited by NBA (CIV, CSE, ECE & EEE) | Affiliated to JNTUA)
Nandikotkur Road, Venkayapalli (V), Kurnool - 518452, Andhra Pradesh

## Program Outcomes (PO's):

Engineering Graduates will be able to

❖ **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 modelling to complex engineering activities with an understanding of the limitations.

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

❖ **PO 7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and 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. Communications:** 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 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.

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# G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY: KURNOOL

## DEPARTMENT OF MECHANICAL ENGINEERING

The following are the Course Outcomes of all the courses for the Academic Year 2018-2019 from I-B.Tech to IV B.Tech

**R18 REGULATION**

### I B.TECH I SEM

**Course Name: FUNCTIONAL ENGLISH**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand and remember various aspects of English. |
| CO2 | Analyze the different situations of speaking and writing skills. |
| CO3 | Apply the LSRW skills to the societal Communication. |
| CO4 | Analyze the importance of English in Science and Technological Context. |
| CO5 | Able to demonstrate the acquired knowledge in executing the technical writing. |

Course Name: **MATHEMATICS-I**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Applymechanics for solving engineering problems |
| CO2 | Apply the principles of acoustics for noise cancellation and in designing buildings |
| CO3 | Analyze the applications of ultrasonics in various engineering fields |
| CO4 | Explainthe relationship between elastic constants |
| CO5 | Interpret the concepts of lasers and optical fibers in various applications |

Course Name: **COMPUTER PROGRAMMING**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Comprehend the fundamental concepts of computer hardware and problem solving Abilities |
| CO2 | Knowledge on the basic concepts of algorithms, flow charts and python programming |
| CO3 | Ability to analyze the procedure for providing input and acquire output from the program along with implementation of control statements |
| CO4 | Interpret the importance of functions in programming |
| CO5 | Analyze 3- dimensional coordinate systems and utilization of special functions. |

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Course Name: **ENGINEERING CHEMISTRY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Compare the quality of drinking water with BIS and WHO standards. Illustrate problems associated with hard water and demonstrate industrial water treatment process. |
| CO2 | Demonstrate the corrosion prevention method and apply Nernst equation for calculating electrode and cell potentials. |
| CO3 | Analyze the classification of fuels along with their characteristics and calorific value involving solid fuels, liquid and gaseous fuels. |
| CO4 | Explain different types of polymers and their applications, demonstrate the mechanism of conduction and conducting polymers. |
| CO5 | Summarize the underlying chemistry of engineering materials involving Cement, lubricants. |

Course Name: **ENVIRONMENTAL STUDIES**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Solve environmental problems through higher level of personal involvement and interest. |
| CO2 | Apply ecological morals to keep up amicable connection among nature and human beings. |
| CO3 | Recognize the interconnectedness of human dependence on the earth's ecosystems. |
| CO4 | Apply environmental laws for the protection of environment and wildlife. |
| CO5 | Influence society in proper utilization of goods and services |

Course Name: **ENGLISH LANGUAGE COMMUNICATION SKILLS (ELCS) LAB**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Become active participants in the learning process and acquire proficiency in spoken English. |
| CO2 | Speak with clarity and confidence thereby enhance employability skills. |
| CO3 | Analyze the English speech sounds, stress, rhythm, intonation and syllable Division for better listening and speaking comprehension. |
| CO4 | Evaluate and exhibit acceptable etiquette essential in social and professional settings |
| CO5 | Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English. |

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Course Name: **ENGINEERING CHEMISTRY LAB**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Determine the cell constant and conductance of solutions |
| CO2 | Prepare advanced polymer materials |
| CO3 | Determine the physical properties like surface tension, adsorption and viscosity |
| CO4 | Estimate the Iron and Calcium in cement |
| CO5 | Calculate the hardness of water and calculation of dissolved oxygen percentages |

Course Name: **COMPUTER PROGRAMMING LAB**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Design solutions to mathematical problems & Organize the data for solving the problem |
| CO2 | Understand and implement modular approach using python |
| CO3 | Learn and implement various data structures provided by python library including string, list, dictionary and its operations etc |
| CO4 | Understands about files and its applications. |
| CO5 | Develop real-world applications, files and exception handling provided by python |

### I B.TECH II SEM

Course Name: **ENGLISH FOR PROFESSIONAL COMMUNICATION**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English |
| CO2 | Apply grammatical structures to formulate sentences and correct word forms |
| CO3 | Analyze discourse markers to speak clearly on a specific topic in informal discussions |
| CO4 | Evaluate reading/listening texts and to write summaries based on global comprehension of these texts. |
| CO5 | Create a coherent paragraph interpreting a figure/graph/chart/table |

Course Name: **MATHEMATICS-II**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply the mathematical principles to solve second and higher order differential equations |
| CO2 | Analyze the non- homogeneous linear differential equations along with method of variation of parameters |
| CO3 | Apply the concept of higher order differential equations to the various streams like Mass spring system and L-C-R Circuit problems |

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| CO4 | Apply a range of techniques to find solutions of standard PDEs and basic properties of standard PDEs |
|-----|------|
| CO5 | Analyze the vector calculus involving divergence, curl and their properties along with vector identities |

Course Name: **MATERIAL SCIENCE AND ENGINEERING**

| # | COURSE OUTCOMES |
|---|-----------------|
| CO1 | Identify the properties of the crystallization of ferrous and nonferrous materials. |
| CO2 | Construct the equilibrium diagrams by experimental methods. |
| CO3 | Make use of advanced composite materials in manufacturing of components and sophisticated machine. |
| CO4 | Improve the properties of ferrous and nonferrous materials using different heattreatment processes. |
| CO5 | Select the suitable materials for various engineering applications. |

Course Name: **ENGINEERING PHYSICS**

| # | COURSE OUTCOMES |
|---|-----------------|
| CO1 | applymechanics for solving engineering problems |
| CO2 | apply the principles of        acoustics for noise cancellation and in designing buildings |
| CO3 | analyze the applications of ultrasonics in various engineering fields |
| CO4 | explainthe relationship between elastic constants |
| CO5 | interpret the concepts of lasers and optical fibers in various applications |

Course Name: **ENGINEERING DRAWING**

| # | COURSE OUTCOMES |
|---|-----------------|
| CO1 | Learning conventions of Drawing, which is an Universal Language Of Engineers. Also Interpret and Sketch the various curves which Including ellipse, parabola, hyperbola |
| CO2 | Analyze and draft the orthographic projections of points and lines |
| CO3 | Analyze and sketch the orthographic projections of planes and solids |
| CO4 | Revise and Improve their visualization skills in the development of new products |
| CO5 | Construct the isometric projection of an object employing orthographic projections |

Course Name: **MATERIAL SCIENCE AND ENGINEERING LABORATORY**

| # | COURSE OUTCOMES |
|---|-----------------|
| CO1 | Make use of different material samples for investigating micro structures. |

| CO2 | Interpret the microstructures of materials usingmetallurgical microscope |
|---|---|
| CO3 | Measure the hardenability of mild steel samples. |
| CO4 | Improve the properties of materials using various heat treatment processes. |
| CO5 | Compare the properties of different materials with temperature variation. |

Course Name: **ENGINEERING PHYSICS LAB**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | estimate the mechanical properties of materials |
| CO2 | determine moment of inertia of a flywheel |
| CO3 | measure the velocity of ultrasonics in liquid by applying the basic concepts of ultrasonics |
| CO4 | determinethe wavelength of laser, particle size, numerical aperture and acceptance angle by applying the principles of lasers and optical fibres |
| CO5 | Measure the elastic constants, Poisson's ratio of the material and verifiesHooke'slaw |

Course Name: **ENGG AND IT WORKSHOP LAB**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Develop skill in S/W and H/W trouble shooting, and solve the problems of assembling and OS installation |
| CO2 | prepare slide presentations using the presentation tool |
| CO3 | access the internet and browse it to obtain the required information |
| CO4 | Study the concepts related to fitting and able to identify the various tools of fitting and Foundry |
| CO5 | Identify the various tools and their use in different sections oftin smithy and Welding |

## II B. TECH I SEM

Course Name: **MATHEMATICS-III**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Interpret the Eigen values and Eigen vectors of matrix in terms of the transformation it represents in to a matrix Eigen value problem. Define a quadratic form and determine its nature using Eigen values |
| CO2 | Analyze the non- homogeneous linear differential equations along with method of variation of parameters. |
| CO3 | Understand the technique of interpolation along with Lagrange's formula and Newton's interpolation formulae. |

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| CO4 | Understand and apply the concepts of curve fitting, numerical Differentiation and integration. |
| --- | --- |
| CO5 | Interpret the numerical solutions of ordinary differential equations employing Taylor series, Euler's, Picard's and Runga-kutta methods |

## Course Name: MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

| # | COURSE OUTCOMES |
| --- | --- |
| CO1 | Understand, concepts of economics, managerial economics, scope, nature and Importance of managerial economics, demand determinants, law of demand and itsexceptions. |
| CO2 | Understand elasticity of demand, types and measurement of elasticity of demand, demand forecasting, methods of demand forecasting |
| CO3 | Understand production function, isoquants and isocosts, MRTS, least cost combination of inputs, cobb-Douglas production function and law of return to scale. Types of cost,BEA, BEP. |
| CO4 | Understand market structure, types of markets, price-output determination under Perfect competition, monopoly, monopolistic competition and pricing methods. |
| CO5 | Understand capital, types, sources, estimation of capital requirements, capital Budgeting and techniques of capital budgeting. |

## Course Name: THERMODYNAMICS

| # | COURSE OUTCOMES |
| --- | --- |
| CO1 | Understand the concepts on thermodynamic property, cycle, constraints of equilibrium, reversibility and energy transfer in the form of Work and Heat with various applications |
| CO2 | Understand the how energy transformation occurs from one form into another form in open and closed systems and applying steady flow energy equation and mass balanceequation to various applications |
| CO3 | Understand the Nozzle, Diffuser, Throttling device, Turbine and c o mpressor in laboratories or local industries and understand their working principles practically |
| CO4 | Understand the major difference in working of a heat engine, refrigerator and heatpump. to Calculate the maximum efficiency of a cycle. Also student can learn calculating entropy change for a process, maximum available energy |
| CO5 | Understand the basic laws of ideal gas and gas mixtures and power cycles. |

## Course Name: ENGINEERING MECHANICS

| # | COURSE OUTCOMES |
| --- | --- |
| CO1 | To analyze the basic concepts of rigid bodies subjected to different types of loads and supports. |
| CO2 | To analyze the motion of the bodies considering friction and external loads. |
| CO3 | To determine Centroids and area moment of inertia and centre of gravity and mass moment of inertia of simple and composite figures |
| CO4 | To analyze the perfect frames using method of joints, method of sections & tension coefficient method for vertical , horizontal and inclined loads and COncepts of |

| | |
|---|---|
| | Mechanical vibrations. (Simple, compound and tensional pendulums |
| CO5 | To analyze the motion of particle with and without considering forces |

Course Name: **ENGINEERING DRAWING FOR MECHANICAL ENGINEERS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply orthographic projection concepts to draw projections of right regular solids. |
| CO2 | Make use of sectional planes to draw sectional views of a solid. |
| CO3 | Apply isometric projection concepts to draw isometric projections of right regular solidsand sectioned solids |
| CO4 | Construct Intersection curves when one right regular solid penetrates another rightregular solid. |
| CO5 | Make use of perspective projection concepts to draw simple planes and right regular solids. |

Course Name: **MECHANICS OF SOLIDS LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Analyze the stress-strain diagram for different materials using universal testing machine |
| CO2 | Compare the hardness values for various materials using hardness testing machine |
| CO3 | Determine modulus of elasticity, bending stresses and deflection for different beams |
| CO4 | Estimate the stiffness and shear modulus of springs using tension test |
| CO5 | Asses the toughness and impact strength using impact testing machine. |

Course Name: **COMPUTER AIDED DRAFTING LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Identify the commands in AutoCAD software to draw required objects |
| CO2 | Create the mechanical components in 2 – Dimensional using AutoCAD commands |
| CO3 | Draw the projections of solids using AutoCAD commands |
| CO4 | Draw the sectional views of solids using AutoCAD commands |
| CO5 | Draw the orthographic views of solids from isometric views using AutoCAD commands |

Course Name: **QUANTITATIVE APTITUDE AND REASONING**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Identify the problems by applying mathematical fundamentals |
| CO2 | Apply the suitable logical methods to solve the problems |
| CO3 | Solve the various problems by using quantitative mathematical fundamentals |
| CO4 | Analyse the comprehensive data with logical ability |

## II B. TECH II SEM

Course Name: **MECHANICS OF SOLIDS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Determine stress strain relationship subjected to axial, bending and torsional loads |
| CO2 | Calculate shear and bending moment in simply supported beams, cantilever beams and overhanging beams |
| CO3 | Calculate slope and deflection of beams subjected to loads. |
| CO4 | Analyse strength of beams and sections and calculate flexural and shear stress. |
| CO5 | Analyse and design Thick and Thin cylinders |

Course Name: **THERMAL ENGINEERING – I**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand the concepts of the working of both S.I &amp; C.I engines with the help of indicator diagrams |
| CO2 | Understand the concepts of the working of both S.I & C.I engines with the help of valve and port timing diagrams |
| CO3 | understand the fuel supply systems, cooling, lubrication and ignition systems |
| CO4 | Understand the flame propagation inside cylinder, stages of combustion in S.I and C.I engines and knocking phenomenon in combustion process. |
| CO5 | Understand the working of rotary air compressors and reciprocating air compressors. |

Course Name: **KINEMATICS OF MACHINES**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Explain the various links of machines and mechanisms and find out difference between Machine and mechanism |

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| | |
|------|------------------------------------------------|
| CO2 | Explain the various mechanisms used in machines |
| CO3 | Understood different types of Steering mechanisms |
| CO4 | Identify new and different mechanisms |
| CO5 | Identify different types of GEAR TRAINS |

Course Name: **MANUFACTURING TECHNOLOGY**

| # | COURSE OUTCOMES |
|------|------------------------------------------------|
| CO1 | Select suitable material for preparing the patterns |
| CO2 | Make use of moulding systems to prepare a product |
| CO3 | Recommend the melting and solidification processes for designing the gatingsystem. |
| CO4 | Identify the suitable special casting and welding processes used for the givenapplication |
| CO5 | Identify the process parameters and defects to get quality product |

Course Name: **MACHINE DRAWING**

| # | COURSE OUTCOMES |
|------|------------------------------------------------|
| CO1 | Construct different materials used in engineering practice through conventionalrepresentation. |
| CO2 | Develop skills related to the dimensioning, sectioning and development of views. |
| CO3 | Apply suitable techniques to draw various parts of assembly drawing. |
| CO4 | Make use of the orthographic and isometric projections to draw machine elements |
| CO5 | Plan the part or assembly drawings as per the conventions. |

Course Name: **MECHANICS OF SOLIDS LABORATORY**

| # | COURSE OUTCOMES |
|------|------------------------------------------------|
| CO1 | Perform the experiment on UTM to determine the young's modulus for ductile materials and analyze the various points on stress strain diagram |
| CO2 | Calculate the modulus of rigidity of ductile materials and calculate & compare the Hardness values for various materials. |
| CO3 | Apply the concept of impact loading and to determine impact values for various Materials. |
| CO4 | Perform the experiment on impact test [charpy] and Understand strength of the specimen |
| CO5 | Perform the experiment on bending test and understand young's modulus and |

| | Deflection of beam. |
|---|---|

Course Name: **THERMAL ENGINEERING LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand the concepts on valve timing diagram of SI engine & CI engine |
| CO2 | Understand the the influence of variations in TDC and BDC operations |
| CO3 | Understand the concept of Calculate the IP,BP, brake thermal efficiency |
| CO4 | Understand the concept of Calculate& compare the performance characteristics |
| CO5 | Understand the basics and able to Analyze the efficiency of reciprocating airCOmpressor |

Course Name: **MANUFACTURING TECHNOLOGY LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Identify various casting and welding equipments used in manufacturing processes |
| CO2 | Choose suitable Sand properties of green sand to get quality specimen. |
| CO3 | Determine the sequence of process to complete a job |
| CO4 | Make use of various welding, foundry and forming equipments to prepare the job |
| CO5 | Apply pattern making procedure for casting process |

## III B.TECH I SEM

Course Name: **THERMAL ENGINEERING II**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply power cycles and efficiency enhancement methods to generate power |
| CO2 | Calculate the chimney height and draught for maximum discharge |
| CO3 | Determine the characteristics of flow through nozzle |
| CO4 | Construct the various velocity triangles of steam turbines |
| CO5 | Analyze the working principle and performance of various thermal equipment |

Course Name: **DYNAMICS OF MACHINERY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply gyro-principles to stabilize the motion of vehicle. |
| CO2 | Analyse the forces of the Flywheel in IC Engine |
| CO3 | Estimate the range of speeds of various governors suitable for applications |

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| | |
|---|---|
| CO4 | Solve problems on balancing of rotating masses and reciprocating masses in V- engine and multi cylinder engines |
| CO5 | Evaluate the critical speed of the shaft and simple vibration calculations of rotor system |

Course Name: **DESIGN OF MACHINE ELEMENTS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply the design process and theories of failure for designing different machine elements. |
| CO2 | Solve the problems related to simple and complex components under different loads using Goodman's and Soderberg's criteria. |
| CO3 | Estimate the stress induced in riveted and bolted joints under different load conditions |
| CO4 | Analyze the failures in shafts, cotter joint and knuckle joint subjected to various loads. |
| CO5 | Design the keys, rigid and flexible couplings as per the standards suitable to applications. |

Course Name: **FLUID MECHANICS AND HYDRAULIC MACHINES**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Analyze properties of fluids under different conditions. Identify the fluid flow patterns using different equations |
| CO2 | Determine fluid flow using devices and principles of fluid mechanics |
| CO3 | Apply boundary layer concepts to various types of flow and forces exerted by jet on vanes. |
| CO4 | Estimate the performance of hydraulic turbines and pumps for various designs. |
| CO5 | Estimate the performance of centrifugal pumps for various design. |

Course Name: **MACHINE TOOLS LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Identify the various machining processes and machine tools |
| CO2 | Classify various metal cutting machines such as lathe, milling, drilling, boring, grinding, shaping, Slotting and planer machines. |
| CO3 | Choose the suitable tools for machining processes.. |
| CO4 | compare the constructional features of machines suitable for various machining Operations. |
| CO5 | Categorize the components of the machines |

Course Name: **PRODUCTION DRAWING PRACTICE**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Construct the conventional representation of different materials used in engineering practice. |
| CO2 | Identify the machine elements and designation of material. |
| CO3 | Apply the drawing techniques to draw various parts of assembly drawing, tolerances, roughness. |
| CO4 | Improve visualization ability of surface roughness and its indications with respect to the material surface |
| CO5 | Plan the production drawings based on design constraints. |

Course Name: **HUMAN VALUES AND PROFESSIONAL ETHICS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply human values and ethics in professional life. |
| CO2 | Develop the moral ideals to maintain good relationships with people. |
| CO3 | Solve environmental related problems by keeping health of human being into consideration. |
| CO4 | Make use of the fundamental rights and human rights in life for individual dignity |
| CO5 | Build the sound health system both physically and mentally by practicing yoga, karate, sports etc. |

## III B.TECH II SEM

Course Name: **OPERATIONS RESEARCH**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply various Operations Research models and methods to solve real world problems |
| CO2 | Solve Linear Programming, assignment, sequencing, game theory, queuing, transportation and project management problems for optimum solution |
| CO3 | Evaluate various alternatives available to find optimal solution for real world problems |
| CO4 | Choose the best strategies to maximize the profit or minimize loss in the presence of a COmpetitor |
| CO5 | Classify the best operating policy for the efficient use of resources |

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Course Name: **DESIGN OF TRANSMISSION SYSTEMS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Assess the type of stresses induced in crane hooks, C-clamps and drives subjected to various loadings. |
| CO2 | Design different types of bearings for suitable applications. |
| CO3 | Design springs and power screws under different load conditions as per the practical situation. |
| CO4 | Solve the problems related to spur and helical gears for power transmission. |
| CO5 | Analyze the stresses induced in IC engine parts subjected to various loads. |

Course Name: **HEAT TRANSFER**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply laws of heat transfer in thermal analyses of engineering systems. |
| CO2 | Calculate the amount of heat transfer in conduction, convection and radiation modes. |
| CO3 | Discuss the concept of conduction heat transfer and its applications. |
| CO4 | Analyze the free and forced convective heat transfer for fluids. |
| CO5 | Analyze the concept of radiative heat transfer between black bodies and grey bodies. |

Course Name: **METAL FORMING PROCESS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply hot working and cold working processes to workpiece for obtaining a final product |
| CO2 | Apply the mechanism of deformation for different metals |
| CO3 | Analyze the effect of process parameters influencing metal forming |
| CO4 | Identify the metal forming process used for given application |
| CO5 | Examine effects of friction, lubrication and causes of common defects in metal forming |

Course Name: **NON CONVENTIONAL SOURCE OF ENERGY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Identify various conventional and non-conventional sources of energy. |
| CO2 | Estimate the energy collection using suitable equipment |
| CO3 | Compare different energy conversion systems within the available resources for better utilization |

| CO4 | Make use of the suitable energy storage methods for real-time requirements |
| CO5 | Analyze the advanced power generation systems like Magneto Hydro Dynamics and other methods for future requirements. |

Course Name: **HEAT TRANSFER LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Analyze thermal conductivity in various materials. |
| CO2 | Calculate heat transfer coefficient in various materials. |
| CO3 | Select appropriate materials for improving effectiveness of heat transfer. |
| CO4 | Test the performance and there by improve effectiveness of heat exchanger. |
| CO5 | Calculate emissivity and Stefan's Boltzmann constant for various bodies through radiation. |

Course Name: **MATLAB PROGRAMMING**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand the use of software tools for modelling and analysis ofmathematical concepts for engineering applications |
| CO2 | calculate the inverse of any matrix using MATLAB |
| CO3 | Model and analyze Monte-Carlo simulation for suitable applications |
| CO4 | Assess the Standard Normal Distributionand its importance in engineeringapplications |
| CO5 | Model and analyze simple engineering concepts and its importance inengineering applications |

Course Name: **CAD/CAM LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Construct complex geometries of machine components in sketcher mode. |
| CO2 | Create programs to generate analytical and synthetic curves used in engineering practice. |
| CO3 | Plan 2D and 3D drawings based on design constraints |
| CO4 | Applying CAD/CAM concept to product design and manufacturing. |
| CO5 | Analyze G and M codes for turning and milling components. |

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# IV B.TECH I SEM

**Course Name: PRODUCTION AND OPERATIONS MANAGEMENT**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply the knowledge in management tools to apply in technical organizations. |
| CO2 | Apply forecasting techniques to predict future demand and other parameters |
| CO3 | Make use of plant layout design to facilitate material flow and processing of a product in the most efficient manner through the shortest possible time. |
| CO4 | Apply quality improvement techniques and methods for improvement of quality of product and process |
| CO5 | Determine the inventory and to be able to apply selected techniques for its COntrol and management under different circumstances |

**Course Name: FINITE ELEMENT METHOD**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand the concepts behind formulation methods in FEM |
| CO2 | Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements. |
| CO3 | Develop element characteristic equation and generation of global equation. |
| CO4 | Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi symmetric and dynamic problems |
| CO5 | Able to apply suitable boundary conditions to a global equation for solve them displacements, stress and strains induced |

**Course Name: INSTRUMENTATION AND CONTROL SYSTEMS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Recognize the importance of basic principles, configuration and functional description of measuring instruments. |
| CO2 | Describe performance characteristics of an instrument when the device is exposed to measure dynamic inputs and error control. |
| CO3 | Categorize the measuring instruments based on the principle of working with the physical parameters such as displacement, temperature and pressure. |

| CO4 | Explain calibration of instruments for measurement of all types of mechanical parameters |
|------|------|
| CO5 | Demonstrate working principle of level measuring devices for ascertaining liquid level and choose appropriate device for controlling fluid level in industrial applications. |
| CO6 | Make use of appropriate instrument for measuring Speed, Acceleration and Vibration by considering different aspects. |

Course Name: **ADDITIVE MANUFACTURING**

| # | COURSE OUTCOMES |
|------|------|
| CO1 | History and Development of Additive manufacturing, Applications, and RP data formats. |
| CO2 | Basic Concept Reverse Engineering and Software's for Additive Manufacturing. |
| CO3 | Principle, Process, Materials, Advantages of Solid and Liquid Based AM Systems. |
| CO4 | Principle and Process of Selective Laser Sintering of Powder Based AM Systems |
| CO5 | Principle, Process, Advantages, Limitations, Applications of BPM, SDM, AM systems |

Course Name: **INSTRUMENTATION AND CONTROL SYSTEMS LAB**

| # | COURSE OUTCOMES |
|------|------|
| CO1 | Understand basic principles of instrumentation and control systems |
| CO2 | Apply calibration of measuring instruments for linear and angular displacement. A1339.3: Understand calibration of measuring instruments for temperature |
| CO3 | Apply calibration of measuring instruments of flow and speed measurement |
| CO4 | Demonstrate working principle of level measuring devices for ascertaining liquid level and choose appropriate device for controlling fluid level in industrial applications. |
| CO5 | Make use of appropriate instrument for measuring Speed, Acceleration and Vibration by considering different aspects. |

Course Name: **COMPUTER AIDED ENGINEERING LABORATORY**

| # | COURSE OUTCOMES |
|------|------|
| CO1 | Apply mathematical skills in the design and analysis of model generations and analysis. |

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| CO2 | Exercise analytical skills in model verifications and interpretations of FEA results. |
|-----|------------------------------------------------------------------------------------------|
| CO3 | Apply knowledge from component design in projects |
| CO4 | Detailing a conceptual design involves determining material specifications, Dimensions, tolerances, performance measures, etc |
| CO5 | Understand the basic concepts of modelling for analysis and manufacturability. |

Course Name: **FUNDAMENTALS OF IOT**

| # | COURSE OUTCOMES |
|-----|------------------------------------------------------------------------------------------|
| CO1 | Analyze IoT applications using IoT enablers and connectivity layers, components. |
| CO2 | Distinguish sensors and actuators in terms of their functions andapplications |
| CO3 | Interface I/O devices, Sensors using Arduino UNO |
| CO4 | Develop Raspberry Pi Interfacing programs using pythonconcepts |
| CO5 | Apply Raspberry Pi and Arduino Uno programming for IoT bases projects |

### IV B.TECH II SEM

Course Name: **BASIC DATA STRUCTURES**

| # | COURSE OUTCOMES |
|-----|------------------------------------------------------------------------------------------|
| CO1 | Analyze the time and space complexities of algorithms |
| CO2 | Apply various operations on linear data structures |
| CO3 | Design searching and sorting techniques for a given application |
| CO4 | Develop nonlinear programming for optimization techniques |
| CO5 | Develop nonlinear programming for optimization techniques |

# G. PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY: KURNOOL

## DEPARTMENT OF MECHANICAL ENGINEERING

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The following are the Course Outcomes of all the courses for the Academic Year 2019-2020 from I-B.Tech to Iv B.Tech

**R19 REGULATION**

### I B.TECH I SEM

**Course Name: MATHEMATICS-I**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Develop the use of matrix algebra techniques that is needed by engineers for practical applications |
| CO2 | Interpret the Eigen values and Eigen vectors of matrix in terms of the transformation it represents in to a matrix Eigen value problem |
| CO3 | Utilize mean value theorems to real life problems |
| CO4 | familiarize with functions of several variables which is useful in optimization |
| CO5 | Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems |

**Course Name: ENGINEERING PHYSICS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | applymechanics for solving engineering problems |
| CO2 | apply the principles of acoustics for noise cancellation and in designing buildings |
| CO3 | analyze the applications of ultrasonics in various engineering fields |
| CO4 | explainthe relationship between elastic constants |
| CO5 | interpret the concepts of lasers and optical fibers in various applications |

**Course Name: COMPUTER PROGRAMMING**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Comprehend the fundamental concepts of computer hardware and problem solving Abilities |
| CO2 | Knowledge on the basic concepts of algorithms, flow charts and python programming |
| CO3 | Ability to analyze the procedure for providing input and acquire output from the program along with implementation of control statements |
| CO4 | Interpret the importance of functions in programming |

| # | |
|---|---|
| CO5 | Analyze 3- dimensional coordinate systems and utilization of special functions. |

Course Name: **COMMUNICATIVE ENGLISH**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English |
| CO2 | Apply grammatical structures to formulate sentences and correct word forms |
| CO3 | Analyze discourse markers to speak clearly on a specific topic in informal discussions |
| CO4 | Evaluate reading/listening texts and to write summaries based on global comprehension of these texts. |
| CO5 | Create a coherent paragraph interpreting a figure/graph/chart/table |

Course Name: **ENGLISH LANGUAGE COMMUNICATION SKILLS (ELCS) LAB**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Become active participants in the learning process and acquire proficiency in spoken English. |
| CO2 | Speak with clarity and confidence thereby enhance employability skills. |
| CO3 | Analyze the English speech sounds, stress, rhythm, intonation and syllable Division for better listening and speaking comprehension. |
| CO4 | Evaluate and exhibit acceptable etiquette essential in social and professional settings |
| CO5 | Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English. |

Course Name: **COMMUNICATIVE ENGLISH LAB**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills |
| CO2 | Apply communication skills through various language learning activities |
| CO3 | Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension. |
| CO4 | Evaluate and exhibit acceptable etiquette essential in social and professional Settings |
| CO5 | Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English. |

Course Name: **ENGINEERING PHYSICS LAB**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | estimate the mechanical properties of materials |

| | |
|---|---|
| CO2 | determine moment of inertia of a flywheel |
| CO3 | measure the velocity of ultrasonics in liquid by applying the basic concepts of ultrasonics |
| CO4 | determinethe wavelength of laser, particle size, numerical aperture and acceptance angle by applying the principles of lasers and optical fibres |
| CO5 | Measure the elastic constants, Poisson's ratio of the material and verifiesHooke'slaw |

## Course Name: **COMPUTER PROGRAMMING LAB**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Design solutions to mathematical problems & Organize the data for solving the problem |
| CO2 | Understand and implement modular approach using python |
| CO3 | Learn and implement various data structures provided by python library including string, list, dictionary and its operations etc |
| CO4 | Understands about files and its applications. |
| CO5 | Develop real-world applications, files and exception handling provided by python |

## I B.TECH II SEM

## Course Name: **MATHEMATICS-II**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply the mathematical principles to solve second and higher order differential equations |
| CO2 | Analyze the non- homogeneous linear differential equations along with method of variation of parameters |
| CO3 | Apply the concept of higher order differential equations to the various streams like Mass spring system and L-C-R Circuit problems |
| CO4 | Apply a range of techniques to find solutions of standard PDEs and basic properties of standard PDEs |
| CO5 | Analyze the vector calculus involving divergence, curl and their properties along with vector identities |

## Course Name: **ENGINEERING CHEMISTRY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Compare the quality of drinking water with BIS and WHO standards. Illustrate problems associated with hard water and demonstrate industrial water treatment process. |
| CO2 | Demonstrate the corrosion prevention method and apply Nernst equation for calculating electrode and cell potentials. |
| CO3 | Analyze the classification of fuels along with their characteristics and calorific value involving solid fuels, liquid and gaseous fuels. |

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| | |
|---|---|
| CO4 | Explain different types of polymers and their applications, demonstrate the mechanism of conduction and conducting polymers. |
| CO5 | Summarize the underlying chemistry of engineering materials involving Cement, lubricants. |

Course Name: **DATA STRUCTURES**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Learn to choose appropriate data structure as applied to specified problem definition. |
| CO2 | Design and analyze linear and non-linear data structures. |
| CO3 | Design algorithms for manipulating linked lists, stacks, queues, trees and graphs in python |
| CO4 | Demonstrate advantages and disadvantages of specific algorithms and data structures |
| CO5 | Develop a base for advanced computer science study. |

Course Name: **ENGINEERING MECHANICS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | To analyze the basic concepts of rigid bodies subjected to different types of loads and supports. |
| CO2 | To analyze the motion of the bodies considering friction and external loads. |
| CO3 | To determine Centroids and area moment of inertia and centre of gravity and mass moment of inertia of simple and composite figures. |
| CO4 | To analyse the motion of particle without considering forces and considering forces |
| CO5 | To analyze the perfect frames using method of joints, method of sections & tension coefficient method for vertical , horizontal and inclined loads and concepts of Mechanical vibrations. (Simple, compound and torsional pendulums) |

Course Name: **ENGINEERING GRAPHICS AND COMPUTER AIDED DRAFTING**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Learning conventions of Drawing, which is an Universal Language Of Engineers. Also Interpret and Sketch the various curves which Including ellipse, parabola, hyperbola |
| CO2 | Analyze and draft the orthographic projections of points and lines |
| CO3 | Analyze and sketch the orthographic projections of planes and solids |
| CO4 | Revise and Improve their visualization skills in the development of new products |
| CO5 | Construct the isometric projection of an object employing orthographic projections |

Course Name: **ENGINEERING CHEMISTRY LAB**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Determine the cell constant and conductance of solutions |
| CO2 | Prepare advanced polymer materials |
| CO3 | Determine the physical properties like surface tension, adsorption and viscosity |
| CO4 | Estimate the Iron and Calcium in cement |
| CO5 | Calculate the hardness of water and calculation of dissolved oxygen percentages |

Course Name: **DATA STRUCTURES LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Learn to choose appropriate data structure as applied to specified problem definition. |
| CO2 | Design and analyze linear and non-linear data structures. |
| CO3 | Design and implement algorithms for manipulating linked lists, stacks, queues, trees and graphs in python |
| CO4 | Implement recursive algorithms as they apply to trees and graphs. |
| CO5 | Formulate new solutions for programming problems or improve existing code using learned algorithms and data structures |

Course Name: **APPLIED MECHANICS LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Acquire knowledge of static and dynamic behavior of the bodies. |
| CO2 | Acquire the knowledge, so that they can understand physical phenomenon with the help of various theories. |
| CO3 | Explain the physical phenomenon with help of diagrams. |
| CO4 | with broad vision with the skills of visualizing and developing their own ideas, and to convert those ideas in to engineering problems and solving those problems with the acquired knowledge of the Engineering mechanics |
| CO5 | Apply the principles of mechanics to analyze structural and machine elements. |

Course Name: **CO-ENGINEERING LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | To acquire the knowledge about the characteristics and working principles of semiconductor diodes, Bipolar Junction Transistor |
| CO2 | Analysis of Single Phase AC Circuits, the representation of alternating quantities and determining the power in these circuits |
| CO3 | Able to Measure the amplitude and frequency utilizing oscilloscope and analyze the fabrication processes of printed circuit boards |
| CO4 | Apply wood working skills in real world applications. Build different parts with metal sheets in real world applications |
| CO5 | Apply fitting operations in various applications |

Course Name: **TRANSFORM TECHNIQUESAND NUMERICAL METHODS**

| # | COURSE OUTCOMES |
|-----|-----------------|
| CO1 | Apply Laplace transforms to solve ordinary differential equations. |
| CO2 | Build Fourier series and Fourier transforms of a given function. |
| CO3 | Apply numerical methods to solve algebraic and transcendental equations. |
| CO4 | Derive interpolating polynomials using interpolation formulae. |
| CO5 | Solve differential and integral equations numerically. |

Course Name: **THERMODYNAMICS**

| # | COURSE OUTCOMES |
|-----|-----------------|
| CO1 | Apply the concepts of thermodynamics in the form of Work and Heat to various engines |
| CO2 | Make use of energy equations for steady flow of fluids. |
| CO3 | Make use of energy equations for steady flow of fluids. |
| CO4 | Determine the efficiency of the cycles for various applications |
| CO5 | Analyze basic laws of ideal gas, power cycles and refrigeration cycles for various applications |

Course Name: **MECHANICS OF SOLIDS**

| # | COURSE OUTCOMES |
|-----|-----------------|
| CO1 | Analyze the types of stresses, strains and elastic constants of mechanicalcomponents |
| CO2 | Construct shear force and bending moment diagrams for beams subjected to variousloads. |
| CO3 | Formulate the bending and shear stress equations and shear stress distribution forbeams and shafts |
| CO4 | Solve problems related to slope and deflection equations for beams subjected tovarious loads |
| CO5 | Estimate hoop and longitudinal stresses in thin and thick cylinders |

Course Name: **MATERIAL SCIENCE AND ENGINEERING**

| # | COURSE OUTCOMES |
|-----|-----|
| CO1 | Identify the properties of the crystallization of ferrous and nonferrous materials. |
| CO2 | Construct the equilibrium diagrams by experimental methods. |
| CO3 | Make use of advanced composite materials in manufacturing of components andsophisticated machine. |
| CO4 | Improve the properties of ferrous and nonferrous materials using different heattreatment processes. |
| CO5 | Select the suitable materials for various engineering applications. |

Course Name: **ENGINEERING DRAWING FOR MECHANICAL ENGINEERS**

| # | COURSE OUTCOMES |
|-----|-----|
| CO1 | Apply orthographic projection concepts to draw projections of right regular solids. |
| CO2 | Make use of sectional planes to draw sectional views of a solid. |
| CO3 | Apply isometric projection concepts to draw isometric projections of right regular solidsand sectioned solids |
| CO4 | Construct Intersection curves when one right regular solid penetrates another rightregular solid. |
| CO5 | Make use of perspective projection concepts to draw simple planes and right regular solids. |

Course Name: **MECHANICS OF SOLIDS LABORATORY**

| # | COURSE OUTCOMES |
|-----|-----|
| CO1 | Analyze the stress-strain diagram for different materials using universal testing machine |
| CO2 | Compare the hardness values for various materials using hardness testing machine |
| CO3 | Determine modulus of elasticity, bending stresses and deflection for different beams |
| CO4 | Estimate the stiffness and shear modulus of springs using tension test |
| CO5 | Asses the toughness and impact strength using impact testing machine. |

Course Name: **MATERIAL SCIENCE AND ENGINEERING LABORATORY**

| # | COURSE OUTCOMES |
|-----|-----|
| CO1 | Make use of different material samples for investigating micro structures. |
| CO2 | Interpret the microstructures of materials usingmetallurgical microscope |

| CO3 | Measure the hardenability of mild steel samples. |
| --- | --- |
| CO4 | Improve the properties of materials using various heat treatment processes. |
| CO5 | Compare the properties of different materials with temperature variation. |

Course Name: **COMPUTER AIDED DRAFTING LABORATORY**

| # | COURSE OUTCOMES |
| --- | --- |
| CO1 | Identify the commands in AutoCAD software to draw required objects |
| CO2 | Create the mechanical components in 2 – Dimensional using AutoCAD commands |
| CO3 | Draw the projections of solids using AutoCAD commands |
| CO4 | Draw the sectional views of solids using AutoCAD commands |
| CO5 | Draw the orthographic views of solids from isometric views using AutoCAD commands |

Course Name: **QUANTITATIVE APTITUDE AND REASONING – I**

| # | COURSE OUTCOMES |
| --- | --- |
| CO1 | Identify the problems by applying mathematical fundamentals |
| CO2 | Apply the suitable logical methods to solve the problems |
| CO3 | Solve the various problems by using quantitative mathematical fundamentals |
| CO4 | Analyse the comprehensive data with logical ability |

Course Name: **ENVIRONMENTAL SCIENCE**

| # | COURSE OUTCOMES |
| --- | --- |
| CO1 | Solve environmental problems through higher level of personal involvement and interest. |
| CO2 | Apply ecological morals to keep up amicable connection among nature and human beings. |
| CO3 | Recognize the interconnectedness of human dependence on the earth's ecosystems. |
| CO4 | Apply environmental laws for the protection of environment and wildlife. |
| CO5 | Influence society in proper utilization of goods and services |

# II B. TECH II SEM

Course Name: **FLUID MECHANICS & HYDRAULIC MACHINES**

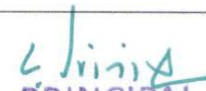| # | COURSE OUTCOMES |
|---|---|
| CO1 | Analyze properties of fluids under different conditions |
| CO2 | Identify the fluid flow patterns using different equations |
| CO3 | Determine fluid flow using devices and principles of fluid mechanics |
| CO4 | Apply boundary layer concepts to various types of flow and forces exerted by jet onvanes |
| CO5 | Estimate the performance of hydraulic turbines and pumps for various designconsiderations |

Course Name: **KINEMATICS OF MACHINERY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Differentiate mechanism, machine and structure with respect to kinematic motions. |
| CO2 | Analyse the mechanism of straight-line motion, steering and Hooke's joint as persuitable applications. |
| CO3 | Draw velocity and acceleration diagrams by using relative velocity method and instantaneous center method. |
| CO4 | Solve the problems related to gears and gear trains using suitable methods. |
| CO5 | Analyze cam profile design with specified contour |

Course Name: **I.C. ENGINES**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Identify constructional features and working principles of the S.I and C.I engines. |
| CO2 | Analyze the stages of combustion in S.I and C.I engines for better performance. |
| CO3 | Apply various performance methods to increase the engine efficiency. |
| CO4 | Identify constructional features and working principles of air compressors. |
| CO5 | select suitable automobile systems for internal combustion engine. |

Course Name: **MANUFACTURING TECHNOLOGY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Select suitable material for preparing the patterns |
| CO2 | Make use of moulding systems to prepare a product |

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| CO3 | Recommend the melting and solidification processes for designing the gatingsystem. |
|-----|-----------------------------------------------------------------------------------|
| CO4 | Identify the suitable special casting and welding processes used for the givenapplication |
| CO5 | Identify the process parameters and defects to get quality product |

Course Name: **COMPUTER AIDED MACHINE DRAWING**

| # | **COURSE OUTCOMES** |
|------|---------------------|
| CO1 | Construct different materials used in engineering practice through conventionalrepresentation. |
| CO2 | Develop skills related to the dimensioning, sectioning and development of views. |
| CO3 | Apply suitable techniques to draw various parts of assembly drawing. |
| CO4 | Make use of the orthographic and isometric projections to draw machine elements |
| CO5 | Plan the part or assembly drawings as per the conventions. |

Course Name: **FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY**

| # | **COURSE OUTCOMES** |
|------|---------------------|
| CO1 | Analyze procedure for performance of various experiments |
| CO2 | Calibrate flow discharge measuring devices used in pipes, channels and tanks. |
| CO3 | Analyze the fluid flow through pipes with different materials and sizes. |
| CO4 | Determine coefficient of discharge of fluid flow through pipes |
| CO5 | Evaluate the performance analysis of various pumps and turbines. |

Course Name: **I.C ENGINES LABORATORY**

| # | **COURSE OUTCOMES** |
|------|---------------------|
| CO1 | Construct valve and port timing diagram of SI engine and CI engine. |
| CO2 | Analyze the influence of variations in TDC and BDC operations of I.C engine |
| CO3 | Calculate the power and efficiencies of I.C engines. |
| CO4 | Test the performance of IC engine at various loads and Air fuel ratio. |
| CO5 | Calculate the efficiency of reciprocating air compressor |

Course Name: **MANUFACTURING TECHNOLOGY LABORATORY**

| # | **COURSE OUTCOMES** |
|------|---------------------|
| CO1 | Identify various casting and welding equipments used in manufacturing processes |

| CO2 | Choose suitable Sand properties of green sand to get quality specimen. |
|------|------|
| CO3 | Determine the sequence of process to complete a job |
| CO4 | Make use of various welding, foundry and forming equipments to prepare the job |
| CO5 | Apply pattern making procedure for casting process |

Course Name: **HUMAN VALUES AND PROFESSIONAL ETHICS**

| # | COURSE OUTCOMES |
|------|------|
| CO1 | Apply human values and ethics in professional life. |
| CO2 | Develop the moral ideals to maintain good relationships with people. |
| CO3 | Solve environmental related problems by keeping health of human being into consideration. |
| CO4 | Make use of the fundamental rights and human rights in life for individual dignity |
| CO5 | Build the sound health system both physically and mentally by practicing yoga, karate, sports etc. |

## III B.TECH I SEM

Course Name: **THERMAL ENGINEERING**

| # | COURSE OUTCOMES |
|------|------|
| CO1 | Apply power cycles and efficiency enhancement methods to generate power |
| CO2 | Calculate the chimney height and draught for maximum discharge |
| CO3 | Determine the characteristics of flow through nozzle |
| CO4 | Construct the various velocity triangles of steam turbines |
| CO5 | Analyze the working principle and performance of various thermal equipment |

Course Name: **DYNAMICS OF MACHINERY**

| # | COURSE OUTCOMES |
|------|------|
| CO1 | Apply gyro-principles to stabilize the motion of vehicle. |
| CO2 | Analyse the forces of the Flywheel in IC Engine |
| CO3 | Estimate the range of speeds of various governors suitable for applications |
| CO4 | Solve problems on balancing of rotating masses and reciprocating masses in V- engine and multi cylinder engines |

| # | COURSE OUTCOMES |
|---|---|
| CO5 | Evaluate the critical speed of the shaft and simple vibration calculations of rotor system |

Course Name: **DESIGN OF MACHINE ELEMENTS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply the design process and theories of failure for designing different machine elements. |
| CO2 | Solve the problems related to simple and complex components under different loads using Goodman's and Soderberg's criteria. |
| CO3 | Estimate the stress induced in riveted and bolted joints under different load conditions |
| CO4 | Analyze the failures in shafts, cotter joint and knuckle joint subjected to various loads. |
| CO5 | Design the keys, rigid and flexible couplings as per the standards suitable to applications. |

Course Name: **MACHINE TOOLS LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Identify various machine tools used in machine shop |
| CO2 | Distinguish the constructional features and operations of general purpose machines |
| CO3 | Determine the sequence of operations to process a job |
| CO4 | Make use of various machining operations to perform metal cutting |
| CO5 | Prepare models using required machine tools |

Course Name: **CAD / CAM LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Construct complex geometries of machine components in sketcher mode. |
| CO2 | Create programs to generate analytical and synthetic curves used in engineering practice. |
| CO3 | Plan 2D and 3D drawings based on design constraints |
| CO4 | Applying CAD/CAM concept to product design and manufacturing. |
| CO5 | Analyze G and M codes for turning and milling components. |

Course Name: **PRODUCTION DRAWING PRACTICE**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Construct the conventional representation of different materials used in engineering practice. |
| CO2 | Identify the machine elements and designation of material. |
| CO3 | Apply the drawing techniques to draw various parts of assembly drawing, tolerances, roughness. |
| CO4 | Improve visualization ability of surface roughness and its indications with respect to the material surface |
| CO5 | Plan the production drawings based on design constraints. |

Course Name: **GENDER SENSITIZATION**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Develop a better understanding of important issues related to gender in contemporary India |
| CO2 | Sensitize to basic dimensions of the biological, sociological, psychological and legal aspects of gender |
| CO3 | Acquire insight into the gendered division of labour and its relation to politics and economics |
| CO4 | Equip to work and live together as equal |
| CO5 | Develop a sense of appreciation of women in all walks of life |

## III B.TECH II SEM

Course Name: **MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Analyze the concepts of managerial economics and financial accounting to make better decisions in the organization |
| CO2 | Analyze the demand, production, cost and break even to know interrelationship among variables and their impact |
| CO3 | Classify the market structure to decide the fixation of suitable price |
| CO4 | Apply capital budgeting techniques to select best investment opportunity |

| CO5 | Analyze and prepare financial statements to assess financial health of business. |
|-----|----------------------------------------------------------------------------------|

Course Name: **DESIGN OF TRANSMISSION SYSTEMS**

| # | COURSE OUTCOMES |
|-----|----------------------------------------------------------------------------------|
| CO1 | Assess the type of stresses induced in crane hooks, C-clamps and drives subjected to various loadings. |
| CO2 | Design different types of bearings for suitable applications. |
| CO3 | Design springs and power screws under different load conditions as per the practical situation. |
| CO4 | Solve the problems related to spur and helical gears for power transmission. |
| CO5 | Analyze the stresses induced in IC engine parts subjected to various loads. |

Course Name: **HEAT TRANSFER**

| # | COURSE OUTCOMES |
|-----|----------------------------------------------------------------------------------|
| CO1 | Apply laws of heat transfer in thermal analyses of engineering systems. |
| CO2 | Calculate the amount of heat transfer in conduction, convection and radiation modes. |
| CO3 | Discuss the concept of conduction heat transfer and its applications. |
| CO4 | Analyze the free and forced convective heat transfer for fluids. |
| CO5 | Analyze the concept of radiative heat transfer between black bodies and grey bodies. |

Course Name: **METAL FORMING PROCESS**

| # | COURSE OUTCOMES |
|-----|----------------------------------------------------------------------------------|
| CO1 | Apply hot working and cold working processes to workpiece for obtaining a final product |
| CO2 | Apply the mechanism of deformation for different metals |
| CO3 | Analyze the effect of process parameters influencing metal forming |
| CO4 | Identify the metal forming process used for given application |
| CO5 | Examine effects of friction, lubrication and causes of common defects in metal forming |

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Course Name: **NON CONVENTIONAL SOURCE OF ENERGY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Identify various conventional and non-conventional sources of energy. |
| CO2 | Estimate the energy collection using suitable equipment |
| CO3 | Compare different energy conversion systems within the available resources for better utilization |
| CO4 | Make use of the suitable energy storage methods for real-time requirements |
| CO5 | Analyze the advanced power generation systems like Magneto Hydro Dynamics and other methods for future requirements. |

Course Name: **HEAT TRANSFER LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Analyze thermal conductivity in various materials. |
| CO2 | Calculate heat transfer coefficient in various materials. |
| CO3 | Select appropriate materials for improving effectiveness of heat transfer. |
| CO4 | Test the performance and there by improve effectiveness of heat exchanger. |
| CO5 | Calculate emissivity and Stefan's Boltzmann constant for various bodies through radiation. |

Course Name: **MATLAB PROGRAMMING**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand the use of software tools for modelling and analysis ofmathematical concepts for engineering applications |
| CO2 | calculate the inverse of any matrix using MATLAB |
| CO3 | Model and analyze Monte-Carlo simulation for suitable applications |
| CO4 | Assess the Standard Normal Distributionand its importance in engineeringapplications |
| CO5 | Model and analyze simple engineering concepts and its importance inengineering applications |

Course Name: **INDIAN CONSTITUTION AND MULTICULTURALISM**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand historical background of the constitution making and its importance forbuilding a democratic India. |

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| CO2 | Explain the role of President and Prime Minister. |
|-----|---------------------------------------------------|
| CO3 | Understand the functioning of three wings of the government ie., executive, legislative and judiciary. |
| CO4 | Understand the value of the fundamental rights and duties for becoming good citizen of India |
| CO5 | Analyze the decentralization of power between central, state and local self-government. |

## IV B.TECH I SEM

Course Name: **OPERATION RESEARCH**

| # | COURSE OUTCOMES |
|-----|-----------------|
| CO1 | Apply various Operations Research models and methods to real world problems. |
| CO2 | Solve Linear Programming, assignment, sequencing, game theory, queuing, transportation and project management problems for optimum solution. |
| CO3 | Evaluate various alternatives available to find optimal solution for real world problems. |
| CO4 | Choose the best strategies to maximize the profit or minimize loss in the presence of a competitor. |
| CO5 | Decide the best operating policy for the efficient use of resources. |

Course Name: **METROLOGY AND MEASUREMENTS**

| # | COURSE OUTCOMES |
|-----|-----------------|
| CO1 | Understand the Limits, Fits and Tolerance. Indian standard system. |
| CO2 | study the different types of Comparators, optical measuring instruments, flatness measurement methods and measuring methods of surface roughness. |
| CO3 | Understand Screw thread elements and measuring methods, Gear tooth profile measurement, CMM, Alignment tests on lathe, milling and drilling machine tools. |
| CO4 | Understand working of various instruments used for measuring for displacement, temperature and pressure. |
| CO5 | understand working of various instruments used for measuring for flow, speed,stress,strain and Vibration |

Course Name: **AUTOMOBILE ENGINEERING**

| # | COURSE OUTCOMES |
|-----|-----------------|
| CO1 | Identify components of various automobile systems including turbo chargers and super chargers |
| CO2 | Examine the environmental implications of automobile emissions |

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| CO3 | Analyze brakes, steering and suspension systems of engine for better performance. |
|------|----------------------------------------------------------------------------------|
| CO4 | Analyze the effect of electrical and transmission system on the performance of an automobile engine. |
| CO5 | Discuss the purpose and methods of various automobile systems and their applications. |

Course Name: **FINITE ELEMENT METHOD**

| # | COURSE OUTCOMES |
|------|------------------|
| CO1 | Understand the concepts behind formulation methods in FEM. |
| CO2 | Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements. |
| CO3 | Develop element characteristic equation and generation of global equation. |
| CO4 | Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi symmetric and dynamic problems |
| CO5 | Able to apply suitable boundary conditions to a global equation for solve them displacements, stress and strains induced |

Course Name: **METROLOGYANDMEASUREMENTS**

| # | COURSE OUTCOMES |
|------|------------------|
| CO1 | Understand the Limits, Fits and Tolerance. Indian standard system. |
| CO2 | study the different types of Comparators, optical measuring instruments, flatness measurement methods and measuring methods of surface roughness. |
| CO3 | Understand Screw thread elements and measuring methods, Gear tooth profile measurement, CMM, Alignment tests on lathe, milling and drilling machine tools. |
| CO4 | Understand working of various instruments used for measuring for displacement, temperature and pressure. |
| CO5 | understand working of various instruments used for measuring for flow, speed,stress,strain and Vibration |

Course Name: **COMPUTER AIDED ENGINEERING LABORATORY**

| # | COURSE OUTCOMES |
|------|------------------|
| CO1 | Apply mathematical skills in the design and analysis of model generations and analysis. |
| CO2 | Exercise analytical skills in model verifications and interpretations of FEA results. |
| CO3 | Apply knowledge from component design in projects |

| CO4 | Detailing a conceptual design involves determining material specifications, Dimensions, tolerances, performance measures, etc |
|------|---------------------------------------------------------------------------------------------------------------------------------|
| CO5 | Understand the basic concepts of modelling for analysis and manufacturability |

Course Name: **FUNDAMENTALS OF IOT**

| # | COURSE OUTCOMES |
|------|-----------------------------------------------------------------------------|
| CO1 | Analyze IoT applications using IoT enablers and connectivity layers, components. |
| CO2 | Distinguish sensors and actuators in terms of their functions andapplications |
| CO3 | Interface I/O devices, Sensors using Arduino UNO |
| CO4 | Develop Raspberry Pi Interfacing programs using pythonconcepts |
| CO5 | Apply Raspberry Pi and Arduino Uno programming for IoT bases projects |

## IV B.Tech II Sem

Course Name: **INDUSTRIAL ENGINEERING**

| # | COURSE OUTCOMES |
|------|-----------------------------------------------------------------------------------------------------------------------------|
| CO1 | Apply the knowledge in management tools to apply in technical organizations. |
| CO2 | Make use of plant layout design to facilitate material flow and processing of a product in the most efficient manner through the shortest possible time. |
| CO3 | Apply various work study techniques towards productivity improvement in industrial and in real life environment. |
| CO4 | Determine the inventory and to be able to apply selected techniques for its control and management under different circumstances. |
| CO5 | Apply quality improvement techniques and methods for improvement of quality of product and process |

Course Name: **BASIC CIVIL ENGINEERING**

| # | COURSE OUTCOMES |
|------|-----------------------------------------------------------------------------|
| CO1 | Classify various materials and components used in building construction |

| CO2 | List out different domains like Structural, Transportation and Geotechnical Engineering in Civil engineering stream |
|-----|---|
| CO3 | Identify types of soils and foundations for various structures |
| CO4 | Measure the linear and angular parameters using concepts of surveying |
| CO5 | Develop water supply system for domestic and irrigational needs |

The following are the Course Outcomes of all the courses for the Academic Year 2020-2021
from   I-B.Tech to IV B.Tech

R20 REGULATION

## I B.TECH I SEM

## COURSE NAME: MATHEMATICS-I

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply the mathematical principles to solve first and second order differential equations |
| CO2 | Analyze the non homogeneous linear differential equations of second and higher order along with Euler – Cauchy's equations and Legendre's linear equation |
| CO3 | Apply the differential equations of second and higher order in various streams ---like Electrical Circuits, Simple Harmonic motion, Deflection of beams |
| CO4 | Estimate the Taylors and Maclaurin series involving Maxima and minima of functions Consisting of 2 variables along with radius of curvature |
| CO5 | Evaluate the multiple integrals involving double and triple integrals along with change of order of integration and apply the multiple integrals to areas and volumes in polar and Cartesian Coordinates. |
| CO6 | Analyze the Concept of vector calculus involving divergence, curl, and green's theorem, and Stokes and Gauss theorems. |

## Course Name: ENGINEERING PHYSICS

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand the concepts of interference, diffraction, LASERS and propagation of light wave through an optical fiber. |
| CO2 | Analyze the concepts of crystallography and Ultrasonic in various engineering fields. |
| CO3 | Apply the concepts of Quantum Mechanics to solve Schrodinger's wave equation and Eigen values, functions of a particle in a potential box. |
| CO4 | Interpret the free electron theory along with equation of electrical conductivity and classification of solids. |
| CO5 | Analyze the importance of semiconductors and magnetic materials in the functioning of electronic devices and in the emerging micro devices. |
| CO6 | Illustrate the properties of superconductors along with their applications and also understand the physics of nano materials. |

## Course Name: PYTHON PROGRAM

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Comprehend the fundamental concepts of computer hardware and problem solving. |
| CO2 | Knowledge on the basic concepts of algorithms, flow charts and python programming. |

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| CO3 | Ability to analyze the procedure for providing input and acquire output from the program along with implementation of control statements. |
|------|---|
| CO4 | Interpret the importance of functions in programming. |
| CO5 | Analyze and modularize the problem and its solution by using functions. |
| CO6 | Ability to relate the concepts of strings, files and pre-processors to the real world Applications. |

Course Name: **COMMUNICATIVE ENGLISH**

| # | COURSE OUTCOMES |
|------|---|
| CO1 | Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English |
| CO2 | Apply grammatical structures to formulate sentences and correct word forms |
| CO3 | Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension. |
| CO4 | Evaluate and exhibit acceptable etiquette essential in social and professional settings |
| CO5 | Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English. |
| CO6 | Improve upon speaking skills over telephone, role plays and public speaking |

Course Name: **ENGINEERING GRAPHICS AND COMPUTER AIDED DRAFTING**

| # | COURSE OUTCOMES |
|------|---|
| CO1 | Construct various curves like ellipse, parabola, hyperbola etc which are used in Engineering drawing. |
| CO2 | Apply orthographic projection concepts to draw projections of points, lines, planes and solids |
| CO3 | Apply development concepts to draw development of surfaces of simple solids |
| CO4 | Analyze discourse markers to speak clearly on a specific topic in informal discussions |
| CO5 | Apply orthographic projection concepts to convert isometric view to orthographic views |
| CO6 | Make use of AutoCAD Software to draw 2D diagrams of various objects |

Course Name: **COMMUNICATIVE ENGLISH LAB**

| # | COURSE OUTCOMES |
|------|---|
| CO1 | Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills |
| CO2 | Apply communication skills through various language learning activities |
| CO3 | Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension. |

| # | COURSE OUTCOMES |
|---|---|
| CO4 | Evaluate and exhibit acceptable etiquette essential in social and professionalsettings |
| CO5 | Create awareness on mother tongue influence and neutralize it in order toimprove fluency in spoken English. |
| CO6 | Improve upon speaking skills over telephone, role plays and public speaking |

Course Name: **ENGINEERING PHYSICS LAB**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand the concept of interference by finding thickness of paper and radius of curvature of Plano-convex lens by forming Parallel fringes and Newton's rings. |
| CO2 | Interpret the concept of diffraction by finding the wavelength of different colors of white light and LASER. |
| CO3 | Examine the behavior of the ferromagnetic material by plotting B-H curve and verifies Biot-Savart's law by using Stewart-Gee's apparatus. |
| CO4 | Analyze the propagation of a wave ina medium by determining the dispersive power of prism, acceptance angle, and numerical aperture of an optical fiber. |
| CO5 | Interpret the nature of a semiconductor by determining its energy gap. |
| CO6 | Demonstrate the concept of diffraction due to single slit by finding the width of the slit. |

Course Name: **PYTHON PROGRAMMING LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Design solutions to mathematical problems & Organize the data for solving theproblem |
| CO2 | Understand and implement modular approach using python |
| CO3 | Learn and implement various data structures provided by python library including string, list, dictionary and its operations etc |
| CO4 | Understands about files and its applications. |
| CO5 | Develop real-world applications, files and exception handling provided by python |
| CO6 | Select appropriate programming construct for solving the problem |

## I B.TECH II SEM

Course Name: **MATHEMATICS-II**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply the mathematical principles to solve second and higher order differential equations. |

| CO2 | Analyze the non- homogeneous linear differential equations along with method of variation of parameters. |
| CO3 | Apply the concept of higher order differential equations to the various streams like Mass spring system and L-C-R Circuit problems. |
| CO4 | Apply a range of techniques to find solutions of standard PDEs and basic properties of standard PDEs. |
| CO5 | Analyze the vector calculus involving divergence, curl and their properties along with vector identities. |
| CO6 | Apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals. |

Course Name: **ENGINEERING CHEMISTRY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply fundamental programming concepts of C for solving general purpose problems. |
| CO2 | Implement functions for organized software development |
| CO3 | Apply various operations on linear data structures. |
| CO4 | Design techniques for efficient searching and sorting of a given application. |
| CO5 | Develop programs on stacks and Queues for real time applications |
| CO6 | Analyze Linear and nonlinear programming for efficiency. |

Course Name: **DATA STRUCTURES**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply fundamental programming concepts of C for solving general purpose problems. |
| CO2 | Implement functions for organized software development |
| CO3 | Apply various operations on linear data structures. |
| CO4 | Design techniques for efficient searching and sorting of a given application. |
| CO5 | Develop programs on stacks and Queues for real time applications |
| CO6 | Analyze Linear and nonlinear programming for efficiency. |

Course Name: **ENGINEERING MECHANICS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Analyze the basic concepts of rigid bodies subjected to different types of loads and supports. |

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| CO2 | Analyze the motion of the bodies considering friction and external loads. |
|-----|---------------------------------------------------------------------------|
| CO3 | Determine centroids, centre of gravity, moment of inertia of simple and composite figures. |
| CO4 | Analyze the motion of particle without considering forces and considering forces, develop equations for different motions. |
| CO5 | Apply Newton's laws and conservation laws to elastic collisions and motion of rigid bodies. |
| CO6 | Analyze the perfect frames using different methods and concepts of Mechanical vibrations. |

Course Name: ENGINEERING WORKSHOP

| # | COURSE OUTCOMES |
|---|-----------------|
| CO1 | Apply wood working skills to make products. |
| CO2 | Perform metal cutting operations in the fitting section to make models. |
| CO3 | Perform simple welding operations to join to metal pieces. |
| CO4 | Apply sheet metal working skills to make required models. |
| CO5 | Evaluate the performance analysis of various pumps and turbines. |
| CO6 | Perform general maintenance works on own at house/ work place. |

Course Name: ENGINEERING CHEMISTRY LAB

| # | COURSE OUTCOMES |
|---|-----------------|
| CO1 | Determine the cell constant and conductance of solutions |
| CO2 | Prepare advanced polymer materials. |
| CO3 | Determine the physical properties like surface tension, adsorption and viscosity |
| CO4 | Estimate the Iron and Calcium in cement |
| CO5 | Calculate the hardness of water and calculation of dissolved oxygen percentages |
| CO6 | Determination of percentage of Iron in Cement sample by colorimetry |

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## Course Name: C AND DATA STRUCTURES LABORATORY

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Develop fundamental programs in C for solving general purpose problems |
| CO2 | Implement functions for reusability and easy maintenance. |
| CO3 | Apply various operations on linear data structures |
| CO4 | Design techniques for efficient searching and sorting of a given application |
| CO5 | Develop programs on stacks and Queues for real time applications. |
| CO6 | Apply Linear and nonlinear programming for efficiency |

## Course Name: APPLIED MECHANICS LABORATORY

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Acquire knowledge of static and dynamic behaviour of the bodies |
| CO2 | Verify the Principle of moments using the bell crank lever apparatus. |
| CO3 | Determine velocity ratio, mechanical advantage and efficiency of single and double gear crab |
| CO4 | Determine the velocity ratio of the machine and to interpret the law of machine |
| CO5 | Analyze the coefficient of static friction between two surfaces |
| CO6 | Apply laws of mechanics to determine efficiency of simple machines with consideration of friction |

## Course Name: UNIVERSAL HUMAN VALUES

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand the significance of value inputs in a classroom and start applying them in their life and profession |
| CO2 | Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc. |
| CO3 | Understand the value of harmonious relationship based on trust and respect in their life and profession |
| CO4 | Understand the role of a human being in ensuring harmony in society and nature. |
| CO5 | Distinguish between ethical and unethical practices, and start working out the strategy to |

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| | actualize a harmonious environment wherever they work. |
|---|---|
| CO6 | Analyze the value of maintaining ethical values in critical situations |

## II B. TECH I SEM

Course Name: **TRANSFORM TECHNIQUES AND NUMERICAL METHODS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply Laplace transforms to solve ordinary differential equations. |
| CO2 | Build Fourier series and Fourier transforms of a given function. |
| CO3 | Apply numerical methods to find our solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations. |
| CO4 | Understand and apply the concepts of curve fitting, numerical differentiation and integration |
| CO5 | Interpret the numerical solutions of ordinary differential equations employing Taylor series, Euler's, Picard's and Runga-kutta methods |
| CO6 | Apply Laplace transforms to solve ordinary differential equations. |

Course Name: **THERMODYNAMICS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply the concepts of thermodynamics in the form of Work and Heat to various engines |
| CO2 | Make use of energy equations for steady flow of fluids. |
| CO3 | Apply the thermodynamic laws to various applications. |
| CO4 | Determine the efficiency of the cycles for various applications |
| CO5 | Analyze basic laws of ideal gas, power cycles and refrigeration cycles for variousapplications |
| CO6 | Apply Laplace transforms to solve ordinary differential equations. |

Course Name: **MECHANICS OF SOLIDS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Analyze the types of stresses, strains and elastic constants of mechanicalcomponents |

| CO2 | Construct shear force and bending moment diagrams for beams subjected to variousloads. |
|-----|------|
| CO3 | Formulate the bending and shear stress equations and shear stress distribution forbeams and shafts |
| CO4 | Solve problems related to slope and deflection equations for beams subjected tovarious loads |
| CO5 | Estimate hoop and longitudinal stresses in thin and thick cylinders |

Course Name: **MATERIAL SCIENCE AND ENGINEERING**

| # | COURSE OUTCOMES |
|---|-----------------|
| CO1 | Identify the properties of the crystallization of ferrous and nonferrous materials. |
| CO2 | Construct the equilibrium diagrams by experimental methods. |
| CO3 | Make use of advanced composite materials in manufacturing of components and sophisticated machine. |
| CO4 | Improve the properties of ferrous and nonferrous materials using different heattreatment processes. |
| CO5 | Select the suitable materials for various engineering applications. |

Course Name: **MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**

| # | COURSE OUTCOMES |
|---|-----------------|
| CO1 | Analyze the concepts of managerial economics and financial accounting tomake better decisions in the organization |
| CO2 | Analyze the demand, production, cost and break even to know interrelationship among variables and their impact |
| CO3 | Classify the market structure to decide the fixation of suitable price |
| CO4 | Apply capital budgeting techniques to select best investment opportunity |
| CO5 | Analyze and prepare financial statements to assess financial health of business. |

Course Name: **MECHANICS OF SOLIDS LABORATORY**

| # | COURSE OUTCOMES |
|---|-----------------|
| CO1 | Analyze the stress-strain diagram for different materials using universal testing machine |
| CO2 | Compare the hardness values for various materials using hardness testing machine |
| CO3 | Determine modulus of elasticity, bending stresses and deflection for different beams |

| CO4 | Estimate the stiffness and shear modulus of springs using tension test |
|-----|---|
| CO5 | Asses the toughness and impact strength using impact testing machine. |

Course Name: **MATERIAL SCIENCE AND ENGINEERING LABORATORY**

| # | COURSE OUTCOMES |
|-----|---|
| CO1 | Make use of different material samples for investigating micro structures. |
| CO2 | Interpret the microstructures of materials usingmetallurgical microscope |
| CO3 | Measure the hardenability of mild steel samples. |
| CO4 | Improve the properties of materials using various heat treatment processes. |
| CO5 | Compare the properties of different materials with temperature variation. |

Course Name: **COMPUTER AIDED DRAFTING LABORATORY**

| # | COURSE OUTCOMES |
|-----|---|
| CO1 | Identify the commands in AutoCAD software to draw required objects |
| CO2 | Create the mechanical components in 2 – Dimensional using AutoCAD commands |
| CO3 | Draw the projections of solids using AutoCAD commands |
| CO4 | Draw the sectional views of solids using AutoCAD commands |
| CO5 | Draw the orthographic views of solids from isometric views using AutoCAD commands |

Course Name: **SOLID WORKS (SKILL ORIENTED COURSE)**

| # | COURSE OUTCOMES |
|-----|---|
| CO1 | Construct complex geometries of machine components in sketcher mode. |
| CO2 | Demonstrate competency with multiple drawing and modification commands inSolid Works. |
| CO3 | Plan 2D and 3D drawings based on design constraints |
| CO4 | Create three-dimensional assemblies incorporating multiple solid models. |
| CO5 | Apply industry standards in the preparation of technical mechanical drawings. |

Course Name: **ENVIRONMENTAL SCIENCE**

| # | COURSE OUTCOMES |
|-----|---|
| CO1 | Solve environmental problems through higher level of personal involvement and interest. |

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| CO2 | Apply ecological morals to keep up amicable connection among nature and human beings. |
|-----|---|
| CO3 | Recognize the interconnectedness of human dependence on the earth's ecosystems. |
| CO4 | Apply environmental laws for the protection of environment and wildlife. |
| CO5 | Influence society in proper utilization of goods and services |

## II B. TECH II SEM

Course Name: **PROBABILITY AND STATISTICS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Adopt correlation methods and principle of least squares, regressionanalysis. |
| CO2 | Apply discrete and continuous probability distributions. |
| CO3 | Classify the concepts of data science and its importance. |
| CO4 | Interpret the association of characteristics and through correlation andregression tools. |
| CO5 | Interpret the association of characteristics and through correlation andregression tools. |

Course Name: **MANUFACTURING TECHNOLOGY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Select suitable material for preparing the patterns |
| CO2 | Make use of moulding systems to prepare a product |
| CO3 | Recommend the melting and solidification processes for designing the gatingsystem. |
| CO4 | Identify the suitable special casting and welding processes used for the givenapplication |
| CO5 | Identify the process parameters and defects to get quality product |

Course Name: **KINEMATICS OF MACHINERY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Differentiate mechanism, machine and structure with respect to kinematic motions. |

| CO2 | Analyse the mechanism of straight-line motion, steering and Hooke's joint as per suitable applications. |
|-----|----------------------------------------------------------------------------------------------------------|
| CO3 | Draw velocity and acceleration diagrams by using relative velocity method and instantaneous center method. |
| CO4 | Solve the problems related to gears and gear trains using suitable methods. |
| CO5 | Analyze cam profile design with specified contour |

Course Name: **I.C. ENGINES**

| # | COURSE OUTCOMES |
|---|-----------------|
| CO1 | Identify constructional features and working principles of the S.I and C.I engines. |
| CO2 | Analyze the stages of combustion in S.I and C.I engines for better performance. |
| CO3 | Apply various performance methods to increase the engine efficiency. |
| CO4 | Identify constructional features and working principles of air compressors. |
| CO5 | select suitable automobile systems for internal combustion engine. |

Course Name: **FLUID MECHANICS AND HYDRAULIC MACHINES**

| # | COURSE OUTCOMES |
|---|-----------------|
| CO1 | Analyze properties of fluids under different conditions |
| CO2 | Identify the fluid flow patterns using different equations |
| CO3 | Determine fluid flow using devices and principles of fluid mechanics |
| CO4 | Apply boundary layer concepts to various types of flow and forces exerted by jet on vanes |
| CO5 | Estimate the performance of hydraulic turbines and pumps for various design considerations |

Course Name: **ENGINEERING DRAWING FOR MECHANICAL ENGINEERS**

| # | COURSE OUTCOMES |
|---|-----------------|
| CO1 | Apply orthographic projection concepts to draw projections of right regular solids. |
| CO2 | Make use of sectional planes to draw sectional views of a solid. |
| CO3 | Apply isometric projection concepts to draw isometric projections of right regular solids and sectioned solids. |
| CO4 | Construct Intersection curves when one right regular solid penetrates another right regular solid. |
| CO5 | Make use of perspective projection concepts to draw simple planes and right regular solids. |

Course Name: **MANUFACTURING TECHNOLOGY LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Identify various casting and welding equipments used in manufacturing processes |
| CO2 | Choose suitable Sand properties of green sand to get quality specimen. |
| CO3 | Determine the sequence of process to complete a job |
| CO4 | Make use of various welding, foundry and forming equipments to prepare the job |
| CO5 | Apply pattern making procedure for casting process |

Course Name: **FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Analyze procedure for performance of various experiments |
| CO2 | Calibrate flow discharge measuring devices used in pipes, channels and tanks. |
| CO3 | Analyze the fluid flow through pipes with different materials and sizes. |
| CO4 | Determine coefficient of discharge of fluid flow through pipes |
| CO5 | Evaluate the performance analysis of various pumps and turbines. |

Course Name: **I.C ENGINES LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Construct valve and port timing diagram of SI engine and CI engine. |
| CO2 | Analyze the influence of variations in TDC and BDC operations of I.C engine |
| CO3 | Calculate the power and efficiencies of I.C engines. |
| CO4 | Test the performance of IC engine at various loads and Air fuel ratio. |
| CO5 | Calculate the efficiency of reciprocating air compressor |

Course Name: **COMPUTER AIDED DRAFTING LABORATORY**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand and interpret drawings of machine components so as to prepare assembly drawings either manually and using standard CAD packages. |
| CO2 | Understand the basic analytical fundamentals that are used to create andmanipulate geometric models in a computer program |
| CO3 | Create 2D and 3D models of Engineering Components and gain practical experiencein handling 2D drafting and 3D modelling software systems. |
| CO4 | Apply the basic principles associated with CADD and to demonstrate common drafting techniques and shortcuts used by professionals. |
| CO5 | Model the 3-D geometric information of machine components including assemblies, and automatically generate 2-D production drawings. |

Course Name: **Thermal Engineering - II**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply power cycles and efficiency enhancement methods to generate power |
| CO2 | Calculate the chimney height and draught for maximum discharge. |
| CO3 | Determine the characteristics of flow through nozzle. |
| CO4 | Construct the various velocity triangles of steam turbines |
| CO5 | Analyze the working principle and performance of various thermal equipment |

Course Name: **Dynamics of Machinery**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply gyro-principles to stabilize the motion of vehicle. |
| CO2 | Analyse the forces of the Flywheel in IC Engine |
| CO3 | Estimate the range of speeds of various governors suitable for applications. |
| CO4 | Solve problems on balancing of rotating masses and reciprocating masses in V- engine and multi cylinder engines |
| CO5 | Evaluate the critical speed of the shaft and simple vibration calculations of rotor systems |

Course Name: **Design of Machine Elements**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply the design process and theories of failure for designing different machine elements |
| CO2 | Solve the problems related to simple and complex components under different loads using Goodman's and Soderberg's criteria. |
| CO3 | Estimate the stress induced in riveted and bolted joints under different load conditions. |
| CO4 | Analyze the failures in shafts, cotter joint and knuckle joint subjected to various loads. |
| CO5 | Design the keys, rigid and flexible couplings as per the standards suitable to applications |

Course Name: **Machine Tools**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Identify the various machining processes and machine tools |

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| CO2 | Classify various metal cutting machines such as lathe, milling, and drilling, boring, grinding, shaping, Slotting and planer machines. |
|-----|------|
| CO3 | Choose the suitable tools for machining processes.. |
| CO4 | compare the constructional features of machines suitable for various machining Operations. |
| CO5 | Categorize the components of the machines |

Course Name: **Machine Tools Laboratory**

| # | COURSE OUTCOMES |
|---|------|
| CO1 | Identify various machine tools used in machine shop |
| CO2 | Distinguish the Constructional features and operations of general purpose machines |
| CO3 | Determine the sequence of operations to process a job |
| CO4 | Make use of various machining operations to perform metal cutting |
| CO5 | Prepare models using required machine tools |

Course Name: **COCOMPUTER AIDED DRAFTING LABORATORY**

| # | COURSE OUTCOMES |
|---|------|
| CO1 | Identify the Commands in AutoCAD software to draw required objects |
| CO2 | Create the mechanical Components in 2 – Dimensional using AutoCAD Commands |
| CO3 | Draw the projections of solids using AutoCAD Commands |
| CO4 | Draw the sectional views of solids using AutoCAD Commands |
| CO5 | Draw the orthographic views of solids from isometric views using AutoCADCommands |

### III B. TECH II SEM

Course Name: **Design of Machine Members – II**

| # | COURSE OUTCOMES |
|---|------|
| CO1 | Assess the type of stresses induced in crane hooks, C-clamps and drives subjected to various loadings. |
| CO2 | Design different types of bearings for suitable applications |
| CO3 | Design springs and power screws under different load Conditions as per the practical situation. |
| CO4 | Solve the problems related to spur and helical gears for power transmission |
| CO5 | Analyze the stresses induced in IC engine parts subjected to various loads |

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Course Name: **Heat Transfer**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply laws of heat transfer in thermal analyses of engineering systems. |
| CO2 | Calculate the amount of heat transfer in Conduction, Convection and radiation modes. |
| CO3 | Discuss the Concept of Conduction heat transfer and its applications |
| CO4 | Analyze the free and forced Convective heat transfer for fluids |
| CO5 | Analyze the Concept of radiative heat transfer between black bodies and grey bodies. |

Course Name: **METAL FORMING PROCESS**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply hot working and cold working processes to work piece for obtaining a final product |
| CO2 | Apply the mechanism of deformation for different metals |
| CO3 | Analyze the effect of process parameters influencing metal forming |
| CO4 | Identify the metal forming process used for given application |
| CO5 | Examine effects of friction, lubrication and causes of common defects in metal forming |

Course Name: **Non Conventional Source of Energy**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Identify various Conventional and non-Conventional sources of energy. |
| CO2 | Estimate the energy Collection using suitable equipment |
| CO3 | Compare different energy Conversion systems within the available resources for better utilization |
| CO4 | Make use of the suitable energy storage methods for real-time requirements |
| CO5 | Analyze the advanced power generation systems like Magneto Hydro Dynamics and other methods for future requirements. |

Course Name: **Heat Transfer Laboratory**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Analyze thermal Conductivity in various materials |
| CO2 | Calculate heat transfer Coefficient in various materials |
| CO3 | Select appropriate materials for improving effectiveness of heat transfer. |
| CO4 | Test the performance and there by improve effectiveness of heat exchanger |
| CO5 | Calculate emissivity and Stefan's Boltzmann Constant for various bodies through radiation. |

Course Name: **MATLAB**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand the use of software tools for modeling and analysis ofmathematical Concepts for engineering applications |

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| # | COURSE OUTCOMES |
|---|---|
| CO2 | calculate the inverse of any matrix using MATLAB |
| CO3 | Model and analyze Monte-Carlo simulation for suitable applications |
| CO4 | Assess the Standard Normal Distribution and its importance in engineeringapplications |
| CO5 | Model and analyze simple engineering Concepts and its importance inengineering applications |

Course Name: **INDIAN CONSTITUTION**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand historical background of the Constitution making and its importance forbuilding a democratic India. |
| CO2 | Explain the role of President and Prime Minister. |
| CO3 | Understand the functioning of three wings of the government ie., executive, legislativeand judiciary. |
| CO4 | Understand the value of the fundamental rights and duties for becoming good citizenof India |
| CO5 | Analyze the decentralization of power between central, state and local self-government. |

## IV B.Tech I-SEM

Course Name: **Unconventional Machining Process**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply the selection for processing of different materials and the range of applications with the importance of modern manufacturing technologies |
| CO2 | Make use of the basic mechanism, working principle, process parameters, Applications, limitations and advantages of electro chemical machining(ECM), electrochemical grinding(ECG), & Chemical Machining CM |
| CO3 | Apply the basic mechanism, working principle, process parameters, Applications, limitations and advantages of Electric Discharge machining |
| CO4 | Analyze basic basic mechanism, working principle, process parameters, Applications, limitations and advantages ofElectron Beam Machining( EBM) &Laser Beam Machining (LBM)**3.** |
| CO5 | Applying the above mechanisms for various materials based on the application. |

Course Name: **Finite Element Method**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Understand the concepts behind formulation methods in FEM. |
| CO2 | Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements. |
| CO3 | Develop element characteristic equation and generation of global equation. |
| CO4 | Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi symmetric and dynamic problems |
| CO5 | Able to apply suitable boundary conditions to a global equation for solve them displacements, stress and strains induced |

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Course Name: **Additive Manufacturing**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | History and Development of Additive manufacturing, Applications, and RP data formats. |
| CO2 | Basic Concept Reverse Engineering and Software's for Additive Manufacturing. |
| CO3 | Principle, Process, Materials, Advantages of Solid and Liquid Based AM Systems |
| CO4 | Principle and Process of Selective Laser Sintering of Powder Based AM Systems. |
| CO5 | Principle, Process, Advantages, Limitations, Applications of BPM, SDM, AM systems |

Course Name: **Research Methodology**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Interpret the importance of literature survey to identify the research problem. |
| CO2 | Develop suitable research methodologies to conduct engineering research. |
| CO3 | Apply the principles of research to gather the required data from various sources. |
| CO4 | Evaluate the gathered data by using appropriate statistical techniques. |
| CO5 | Prepare and present the research report effectively with the help of visual aids. |

Course Name: **Intellectual Property Rights**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Analyze ethical and professional issues which arise in the intellectual property law context. |
| CO2 | Apply intellectual property law principles (including copyright, patents, designs and trademarks) to real problems. |
| CO3 | Analyze the social impact of intellectual property law and policy. |
| CO4 | Make use of copyrighted material so that it does not obstruct the progress of human knowledge. |
| CO5 | Analyze IPR policies before filing patentable inventions and discoveries. |

Course Name: **Operation Research**

| # | COURSE OUTCOMES |
|---|---|
| CO1 | Apply various Operations Research models and methods to real world problems. |
| CO2 | Solve Linear Programming, assignment, sequencing, game theory, queuing, transportation and project management problems for optimum solution. |
| CO3 | Evaluate various alternatives available to find optimal solution for real world problems. |
| CO4 | Choose the best strategies to maximize the profit or minimize loss in the presence of a competitor. |
| CO5 | Decide the best operating policy for the efficient use of resources. |

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