

**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 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 | Apply mechanics 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 | Explain the 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: **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.                         |

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 |

|     |  |
|-----|--|
| 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 heat treatment processes. |
| CO5 | Select the suitable materials for various engineering applications.                                  |

Course Name: **ENGINEERING PHYSICS**

| #   | COURSE OUTCOMES   |
|-----|---|
| CO1 | apply mechanics 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 | explain the 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 using metallurgical 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 | determine the 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 verifies Hooke's law   |

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 of 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.  |

|     |   |
|-----|---|
| 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 Runge-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 its exceptions.                 |
| 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 balance equation to various applications                              |
| CO3 | Understand the Nozzle, Diffuser, Throttling device, Turbine and compressor in laboratories or local industries and understand their working principles practically   |
| CO4 | Understand the major difference in working of a heat engine, refrigerator and heat pump. 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 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: **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 & 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 |

|     |   |
|-----|---|
| 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 gating system.        |
| CO4 | Identify the suitable special casting and welding processes used for the given application |
| 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 conventional representation. |
| 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 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 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                              |

### 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 |

|     |   |
|-----|---|
| 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.<br>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   |

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 of mathematical 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 Distribution and its importance in engineering applications                                |
| CO5 | Model and analyze simple engineering concepts and its importance in engineering 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.                                 |

#### 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:<br>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. |

|     |   |
|-----|---|
| 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 and applications   |
| CO3 | Interface I/O devices, Sensors using Arduino UNO                                 |
| CO4 | Develop Raspberry Pi Interfacing programs using python concepts                  |
| CO5 | Apply Raspberry Pi and Arduino Uno programming for IoT based 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       |