

PROGRAMME: MECHANICAL ENGINEERING
JNTUK UNIVERSITY REGULATION R20
FIRST YEAR COURSES (I & II SEMESTER)
Course Outcome's (Co's)
I-I & I-II

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| C101 | CALCULUS & DIFFERENTIAL EQUATIONS-M1 |
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Course Outcomes (Cos)

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| C101.1 | utilize mean value theorems to real life problems (L3) |
| C101.2 | solve the differential equations related to various engineering fields (L3) |
| C101.3 | familiarize with functions of several variables which is useful in optimization (L3) |
| C101.4 | apply double integration techniques in evaluating areas bounded by region (L3) |
| C101.5 | students will also learn important tools of calculus in higher dimensions. |

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| C102 | ENGINEERING PHYSICS |
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Course Outcomes (Cos)

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| C102.1 | Explain the need of coherent sources and the conditions for sustained interference (L2) Identify engineering applications of interference (L3)→ Analyze the differences between interference and diffraction with applications |
| C102.2 | Understand the basic concepts of LASER light Sources (L2) Apply the concepts to learn the types of lasers (L3)→ Identifies the Engineering applications of lasers |
| C102.3 | Explain the concept of dielectric constant and polarization in dielectric materials (L2)→ Summarize various types of polarization of dielectrics |
| C102.4 | Explain how sound is propagated in buildings (L2) Analyze acoustic properties of typically used materials in buildings |

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| C103 | PROGRAMMING FOR PROBLEM SOLVING USING C |
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Course Outcomes (Cos)

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| C103.1 | To write algorithms and to draw flowcharts for solving problems |
| C103.2 | To convert flowcharts/algorithms to C Programs, compile and debug programs |
| C103.3 | To use different operators, data types and write programs that use two-way/multi-way selection |
| C103.4 | To select the best loop construct for a given problem |
| C103.5 | To design and implement programs to analyze the different pointer applications |
| C103.6 | To decompose a problem into functions and to develop modular reusable code |
| C103.7 | To apply File I/O operations |

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| C104 | COMMUNICATIVE ENGLISH |
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Course Outcomes (Cos)

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| C104.1 | Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers |
| C104.2 | Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials |
| C104.3 | Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations |
| C104.4 | Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information |
| C104.5 | Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing |

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| C105 | ENGINEERING DRAWING |
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Course Outcomes (Cos)

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| C105.1 | The student will learn how to visualize 2D & 3D objects |
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| C106 | ENGINEERING PHYSICS LAB |
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Course Outcomes (Cos)

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|---------------|--|
| C106.1 | Knowledge on different lasers |
| C106.2 | Study of variation of magnetic field along the axis of a current carrying circular coil by Stewart & Gee's method. |
| C106.3 | Determination of ultrasonic velocity in given liquid (Acoustic grating) |
| C106.4 | The variation of B versus H by magnetizing the magnetic material (B-H curve). |

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| C107 | PROGRAMMING FOR PROBLEM SOLVING USING C LABORATORY |
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Course Outcomes (Cos)

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| C107.1 | Gains Knowledge on various concepts of a C language. |
| C107.2 | Able to draw flowcharts and write algorithms. |
| C107.3 | Able design and development of C problem solving skills |
| C107.4 | Able to design and develop modular programming skills. |
| C107.5 | Able to trace and debug a program |

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| C108 | ENGLISH COMMUNICATION SKILLS LABORATORY |
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Course Outcomes (Cos)

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|---------------|--|
| C108.1 | Vowels, Consonants, Pronunciation, Phonetic Transcription |
| C108.2 | Word stress-did-syllabic words, poly-syllabic words |
| C108.3 | Stress in compound words, rhythm, intonation, accent neutralization |
| C108.4 | Listening to short audio texts and identifying the context |
| C108.5 | Newspapers reading; Understanding and identifying key terms and structures useful for writing reports. |

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| C109 | ENVIRONMENTAL SCIENCE |
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Course Outcomes (Cos)

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| C109.1 | Understanding of the natural resources. |
| C109.2 | Basic understanding of the ecosystem and its diversity. |
| C109.3 | Acquaintance on various environmental challenges induced due to unplanned and through pogenic activities. |
| C109.4 | An understanding of the environmental impact of developmental activities. |
| C109.5 | Awareness on the social issues, environmental legislation and global treaties |

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| C110 | ENGINEERING CHEMISTRY |
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Course Outcomes (Cos)

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| C110.1 | At the end of this unit, the students will be able to |
| C110.2 | At the end of this unit, the students will be able to Synthesize nonmaterial for modern advances of engineering technology. |
| C110.3 | At the end of this unit, the students will be able to Differentiate petroleum, petrol, synthetic petrol |
| C110.4 | At the end of this unit, the students will be able to Analyze the suitable methods for purification and treatment of hard water and brackish water |

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| C111 | ENGINEERING MECHANICS |
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Course Outcomes (Cos)

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| C111.1 | The student should be able to draw free body diagrams for FBDs for particles and rigid bodies in plane and space and problems to solve the unknown forces, orientations and geometric parameters |
| C111.2 | He should be able to determine centered for lines, areas and center of gravity for volumes and their composites. |
| C111.3 | He should be able to determine area and mass movement of inertia for composite sections |
| C111.4 | He should be able to analyze motion of particles and rigid bodies and apply the principles of motion, work energy and impulse – momentum |

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| C1012 | BASIC ELECTRICAL & ELECTRONICS ENGINEERING |
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Course Outcomes (Cos)

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| C112.1 | To learn the basic principles of electrical circuit law's and analysis |
| C112.2 | To understand principle of operation and construction details of DC machines. |
| C112.3 | Understand principle of operation and construction details of transformers, alternator and 3-Phase induction motor. |
| C112.4 | To study operation of PN junction diode, half wave, full wave rectifiers and OP-AMPs |
| C112.5 | To learn operation of PNP and NPN transistors and various amplifiers. |

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| C113 | THERMODYNAMICS |
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Course Outcomes (Cos)

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|---------------|--|
| C113.1 | Basic concepts of thermodynamics |
| C113.2 | Laws of thermodynamics |
| C113.3 | Laws of thermodynamics |
| C113.4 | Property evaluation of vapors and their depiction in tables and charts |
| C113.5 | CO5: Evaluation of properties of perfect gas mixtures |

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| C114 | WORKSHOP PRACTICE LAB |
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Course Outcomes (Cos)

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|---------------|--|
| C114.1 | Carpentry 1. T-Lap Joint 2. Cross Lap Joint 3. Dovetail Joint 4. Mortise and Tenon Joint |
| C114.2 | Fitting 1. Vie Fit 2. Square Fit 3. Half Round Fit 4. Dovetail Fi |
| C114.3 | Black Smithy 1. Round rod to Square 2. S-Hook 3. Round Rod to Flat Ring 4. Round Rod to Square headed bolt |
| C114.4 | Tin Smithy 1. Taper Tray 2. Square Box without lid 3. Open Scoop 4. Funnel |
| C114.5 | IT Workshop 1.Assembly & Disassembly of Computer |

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| C115 | ENGINEERING CHEMISTRY LABORATORY |
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Course Outcomes (Cos)

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| C115.1 | The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis. Thus at the end of the lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills. |
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| C1015 | BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB |
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Course Outcomes (Cos)

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| C115.1 | Abe to do the PN junction diode characteristics |
| C115.2 | Abe to Transistor CE characteristics, CE amplifiers, OP- amp applications |
| C115.3 | Able to Swinburne's test on D.C. Shunt machine, OC and SC tests |
| C115.4 | Able to do Brake test on 3-phase Induction motor, |
| C115.5 | Brake test on D.C. Shunt Motor |

**PROGRAMME: MECHANICAL ENGINEERING
JNTUK UNIVERSITY REGULATION R20
SECOND YEAR COURSES (I & II SEMESTER)
Course Outcome's (Co's)
II-I & II-II**

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| C201 | VECTOR CALCULUS FOURIER TRANSFORMS and PDE |
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Course Outcomes (Cos)

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|---------------|---|
| C201.1 | interpret the physical meaning of different operators such as gradient, curl and divergence (L5) |
| C201.2 | estimate the work done against a field, circulation and flux using vector calculus (L5) |
| C201.3 | apply the Laplace transform for solving differential equations (L3) |
| C201.4 | find or compute the Fourier series of periodic signals (L3) |
| C201.5 | know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3) |
| C201.6 | identify solution methods for partial differential equations that model physical processes (L3) |

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| C202 | MECHANICS OF SOLIDS |
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Course Outcomes (Cos)

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|---------------|---|
| C202.1 | Model & Analyze the behavior of basic structural members subjected to various loading and support conditions based on principles of equilibrium |
| C202.2 | Understand the apply the concept of stress and strain to analyze and design structural members and machine parts under axial, shear and bending loads, moment and tensional moment. |
| C202.3 | Students are able to analyze beams and draw correct and complete shear and bending moment diagrams forbeams. |
| C202.4 | Students attain a deeper understanding of the loads, stresses, and strains acting on a structure and their relations in the elastic behavior |
| C202.5 | Design and analysis of Industrial components like pressure vessels. |

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| C203 | PRODUCTION TECHNOLOGY |
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Course Outcomes (Cos)

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|----------------|---|
| C203.1. | Able to design the patterns and core boxes for metal casting processes |
| C203.2 | Able to design the gating system for different metallic components |
| C203.3 | Know the different types of manufacturing processes |
| C203.4 | Be able to use forging, extrusion processes |
| C203.5 | Learn about the different types of welding processes used for special fabrication |

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| C204 | KINEMATICS OF MACHINERY |
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Course Outcomes (Cos)

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| C204.1 | Contrive a mechanism for a given plane motion with single degree of freedom. |
| C204.2 | Suggest and analyze a mechanism for a given straight line motion and automobile steering motion. CO3: Analyze the motion (velocity and acceleration) of a plane mechanism. |
| C204.3 | Suggest and analyze mechanisms for a prescribed intermittent motion like opening and closing of IC engine valves etc. |
| C204.4 | Select a power transmission system for a given application and analyze motion of different transmission systems |

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| C205 | COMPUTER AIDED ENGINEERING DRAWING PRACTICE |
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Course Outcomes (Cos)

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| C205.1 | Student gets exposed on working of sheet metal with help of development of surfaces. |
| C205.2 | Student understands how to know the hidden details of machine components with the help of sections and interpenetrations of solids. |
| C205.3 | Student shall exposed to modeling commands for generating 2D and 3D objects using computer aided drafting tools which are useful to create machine elements for comport aid reanalysis. |

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| C206 | FLUID MECHANICS & HYDRAULIC MACHINERY LAB |
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Course Outcomes (Cos)

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| C206.1 | Design 1. Impact of jets on Vanes. 2. Performance Test on Peloton Wheel. 3. Performance Test on Francis Turbine |
| C206.2 | Design a Kaplan Turbine, Single Stage Centrifugal Pump. |
| C206.3 | Determination of friction factor for a given pipeline. |
| C206.4 | Determination of loss of head due to sudden contraction in pipeline |

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| C207 | PRODUCTION TECHNOLOGY LAB |
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Course Outcomes (Cos)

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|---------------|---|
| C207.1 | Design and making of pattern i. Single piece pattern ii. Split pattern |
| C207.2 | Sand properties testing, Mould preparation |
| C207.3 | Study of Basic powder compaction and sintering, TIG/MIG Welding |
| C207.4 | .Study of Resistance Spot Welding, Study of Brazing and soldering & Study of Plastic Molding Process. |

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| C208 | DRAFTING AND MODELING LAB |
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Course Outcomes (Cos)

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| C208.1 | Development of part drawings for various components in the form of orthographic and isometric. |
| C208.2 | Generation of various Surfaces using surface modeling. |
| C208.3 | Study of DXE, IGES files. |
| C208.4 | Generation of various Surfaces using surface modeling |
| C208.5 | Generation of various 3D models through Pad, revolve, shell, sweep, parent child relation |

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| C209 | ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE |
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Course Outcomes (Cos)

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|---------------|---|
| C209.1 | Understand the concept of Traditional knowledge and its importance |
| C209.2 | Know the need and importance of protecting traditional knowledge |
| C209.3 | Know the various enactments related to the protection of traditional knowledge |
| C209.4 | Understand the concepts of Intellectual property to protect the traditional knowledge |

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| C210 | MATERIALS SCIENCE & METALLURGY |
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Course Outcomes (Cos)

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|---------------|--|
| C210.1 | Understand the crystalline structure of different metals and study the stability of phases in different alloy systems. |
| C210.2 | Study the behavior of ferrous and non ferrous metals and alloys and their application in different domains |
| C210.3 | Able to understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals. |
| C210.4 | Grasp the methods of making of metal powders and applications of powder metallurgy |
| C210.5 | Comprehend the properties and applications of ceramic, composites and other advanced methods. |

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| C211 | COMPLEX VARIABLES AND STATISTICAL METHODS |
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Course Outcomes (Cos)

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| C211.1 | apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic (L3) |
| C211.2 | find the differentiation and integration of complex functions used in engineering problems (L5) |
| C211.3 | make use of the Cauchy residue theorem to evaluate certain integrals (L3) |
| C211.4 | apply discrete and continuous probability distributions (L3) |
| C211.5 | design the components of a classical hypothesis test (L6) |
| C211.6 | infer the statistical inferential methods based on small and large sampling tests (L4) |

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| C212 | DYNAMICS OF MACHINERY |
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Course Outcomes (Cos)

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| C212.1 | To compute the frictional losses and transmission in clutches, brakes and dynamometers |
| C212.2 | To determine the effect of gyroscopic couple in motor vehicles, ships and aeroplanes |
| C212.3 | To analyze the forces in four bar and slider crank mechanisms and design a fly wheel |
| C212.4 | To determine the rotary unbalanced mass in reciprocating equipment |
| C212.5 | To determine the unbalanced forces and couples in reciprocating and radial engines |
| C212.6 | To determine the natural frequencies of discrete systems undergoing longitudinal, tensional and transverse vibrations |

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| C213 | THERMAL ENGINEERING - I |
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Course Outcomes (Cos)

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| C213.1 | Derive the actual cycle from fuel-air cycle and air- standard cycle for all practical applications. |
| C213.2 | Explain combustion phenomenon of CI and SI engines and their impact on engine variables. |
| C213.3 | Explain the cycles and systems of a gas turbine and determine the efficiency of gas turbine. |

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| C214 | INDUSTRIAL ENGINEERING AND MANAGEMENT |
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Course Outcomes (Cos)

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| C214.1 | Design and conduct experiments, analyse, interpret data and synthesize valid conclusions |
| C214.2 | Design a system, component, or process, and synthesize solutions to achieve desired needs |
| C214.3 | Use the techniques, skills, and modern engineering tools necessary for engineering practice with appropriate considerations for public health and safety, cultural, societal, and environmental constraints |
| C214.4 | Function effectively within multi-disciplinary teams and understand the fundamental precepts of effective project management |

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| C215 | MECHANICS OF SOLIDS & METALLURGY LAB |
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Course Outcomes (Cos)

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| C215.1 | Test on springs, Compression test on cube |
| C215.2 | Impact test, Punch shear test |
| C215.3 | Preparation and study of the Microstructure of pure metals like Iron, Cu and Al |
| C215.4 | Preparation and study of the Microstructure of Mild steel, Medium carbon steels, High carbon steels. |
| C215.5 | Harden ability of steels by Jominy End Quench Test. |

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| C216 | MACHINE DRAWING PRACTICE |
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Course Outcomes (Cos)

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| C216.1 | Draw and represent standard dimensions of different mechanical fasteners and joints and Couplings |
| C216.2 | Draw different types of bearings showing different components. |
| C216.3 | Assemble components of a machine part and draw the sectional assembly drawing showing the dimensions of all the components of the assembly as per bill of materials |

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| C216.4 | Select and represent fits and geometrical form of different mating parts in assembly drawings. |
| C216.5 | To prepare manufacturing drawings indicating fits, tolerances, surface finish and surface treatment requirements |

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| C217 | THEORY OF MACHINES LAB |
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Course Outcomes (Cos)

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|---------------|--|
| C217.1 | To determine whirling speed of shaft theoretically and experimentally |
| C217.2 | To analyse the motion of a motorized gyroscope when the couple is applied along its spin axis |
| C217.3 | To find the moment of inertia of a flywheel |
| C217.4 | To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism/Four bar mechanism |

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| C218 | PYTHON PROGRAMMING LAB |
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Course Outcomes (Cos)

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| C218.1 | Solve the different methods for linear, non-linear and differential equations |
| C218.2 | Learn the PYTHON Programming language |
| C218.3 | Familiar with the strings and matrices in PYTHON |
| C218.4 | Write the Program scripts and functions in PYTHON to solve the methods |

**PROGRAMME: MECHANICAL ENGINEERING
JNTUK UNIVERSITY REGULATION R20
THIRD YEAR COURSES (I & II SEMISTER)
Course Outcome's (Co's)
III-I & III-II**

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| C301 | Thermal engineering |
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Course Outcomes (Cos)

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| C301.1. | Explain the basic concepts of thermal engineering and boilers. |
| C301.2 | Discuss the concepts of steam nozzles and steam turbines. |
| C301.3 | Gain knowledge about the concepts of reaction turbine and steam condensers. |
| C301.4 | Discuss the concepts of reciprocating and rotary type of compressors |
| C301.5 | Acquire knowledge about the centrifugal and axial flow compressors |

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| C302 | DESIGN OF MACHINE MEMBERS-I |
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Course Outcomes (Cos)

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|---------------|---|
| C302.1 | Judge about materials and their properties along with manufacturing considerations. |
| C302.2 | Gain knowledge about the strength of machine elements |
| C302.3 | Apply the knowledge in designing the riveted and welded joints, keys, cotters and knuckle joints. |
| C302.4 | Apply the knowledge in designing the shafts and shaft couplings |
| C302.5 | Apply the knowledge in designing the mechanical springs |

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| C303 | MACHINING, MACHINE TOOLS& METLORGY |
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Course Outcomes (Cos)

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|---------------|---|
| C303.1 | Discuss the concepts of machining processes. |
| C303.2 | Apply the principles of lathe, shaping, slotting and planning machines. |
| C303.3 | Apply the principles of drilling, milling and boring processes |

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| C303.4 | Analyze the concepts of finishing processes and the system of limits and fits. |
| C303.5 | Learn the concepts of surface roughness and optical measuring instruments. |

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| C304 | NANO TECHNOLOGY (OE-1) |
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Course Outcomes (Cos)

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| C304.1 | Explain about nano-structured materials and their applications. |
| C304.2 | Apply knowledge about the nano crystalline materials, their properties and defects. |
| C304.3 | Justify various techniques of nanofabrication. |
| C304.4 | Apply the tools to characterize nano materials |
| C304.5 | Analyze the applications of nano materials |

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| C305 | RENEWABLE ENERGY SOURCES (PE-1) |
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Course Outcomes (Cos)

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|---------------|---|
| C305.1 | Explain the importance of, solar energy collection and storage. |
| C305.2 | Discuss the wind energy principles |
| C305.3 | Analyze about biomass energy concepts |
| C305.4 | Apply the principles of tidal energy |
| C305.5 | Utilize the concepts of geothermal energy. |

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| C306 | MACHINE TOOLS LABORATORY |
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Course Outcomes (Cos)

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| C306.1 | Demonstrate about general purpose machine tools in the machine shop. |
| C306.2 | Perform various operations on lathe machine. |
| C306.3 | Perceive different operations on drilling machine. |
| C306.4 | Experiment with basic operations on shaping machine. |
| C306.5 | Utilize slotting machine to make keyways. |
| C306.6 | Experiment with the basic operations on milling machine. |

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| C307 | THERMAL ENGINEERING LAB |
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Course Outcomes (Cos)

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|---------------|---|
| C307.1 | Experiment with two stroke and four stroke compression and spark ignition engines for various characteristics. |
| C307.2 | Perceive flash point, fire point, calorific value of different fuels using various apparatus |
| C307.3 | Perform engine friction, heat balance test, volumetric efficiency, load test of petrol and diesel engines |
| C307.4 | Perform speed test, performance test and cooling temperature on petrol and diesel engines. |
| C307.5 | Utilize air compressor for its performance test and to determine efficiency |
| C307.6 | Discuss the principles through assembly and disassembly of 2/3 wheelers, 2/4 stroke engines, tractor, heavy duty engines, boilers and their mountings and accessories |
| C308 | ADVANCED COMMUNICATION SKILLS LAB |

Course Outcomes (Cos)

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|---------------|---|
| C308.1 | Advanced English Communication Skills (AECS) Lab : Acquire vocabulary and use it contextually |
| C308.2 | Listen and speak effectively |
| C308.3 | Develop proficiency in academic reading and writing |
| C308.4 | Increase possibilities of job prospects Communicate confidently in formal and informal contexts |

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| C309 | PROFESSIONAL ETHICS AND HUMAN VALUES |
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Course Outcomes (Cos)

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|---------------|---|
| C309.1 | Judge the concepts of human values. |
| C309.2 | Justify knowledge about the principles of engineering ethics. |
| C309.3 | Interpret engineering as social experimentation. |
| C309.4 | Realize engineers' responsibility for safety and risk. |
| C309.5 | Learn about the engineers' rights and responsibilities |

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| C310 | HEAT TRANSFER |
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Course Outcomes (Cos)

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|---------------|--|
| C310.1 | Apply knowledge about mechanism and modes of heat transfer |
| C310.2 | Understand the concepts of conduction and convective heat transfer |
| C310.3 | Learn about forced and free convection |
| C310.4 | Analyze the concepts of heat transfer with phase change and condensation along with heat |
| C310.5 | Apply the concepts in designing various machine tool elements |

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| C311 | INTRODUCTION TO ARTIFICIAL INTELLIGENCE & MACHINE LEARNING |
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Course Outcomes (Cos)

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| C311.1 | Discuss basic concepts of artificial intelligence, neural networks and genetic algorithms. |
| C311.2 | Apply the principles of knowledge representation and reasoning |
| C311.3 | Learn about Bayesian and computational learning and machine learning |
| C311.4 | Utilize various machine learning techniques. |
| C311.5 | Apply the machine learning analytics and deep learning techniques |

Course Outcomes (Cos)

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| C312 | DESIGN OF MACHINE MEMBERS-II |
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|---------------|--|
| C312.1 | Apply knowledge about the design of bearings. |
| C312.2 | Explain the concepts in designing various engine parts. |
| C312.3 | Utilize the knowledge to design curved beams and power screws |
| C312.4 | Justify power transmission systems and to design pulleys and gear drives |
| C312.5 | Apply the concepts in designing various machine tool elements |

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| C313 | AUTOMOBILE ENGINEERING (PE-2) |
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Course Outcomes (Cos)

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|---------------|--|
| C313.1 | Discuss various components of four wheeler automobile. |
| C313.2 | Apply the knowledge of different parts of transmission system |
| C313.3 | Judge about steering and suspension systems |
| C313.4 | Justify the braking system and electrical system used in automobiles. |
| C313.5 | Analyze the concepts about engine specifications and service, safety and electronic system used in automobiles |

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| C314 | ESSENTIALS OF MECHANICAL ENGINEERING (OE-2) |
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Course Outcomes (Cos)

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|---------------|---|
| C314.1 | Discuss the concepts about stresses and strains. |
| C314.2 | Justify about the components of transmission systems |
| C314.3 | Analyze Problems related to project management techniques. |
| C314.4 | Utilize knowledge about manufacturing processes and materials |
| C314.5 | Learn the concepts of boilers, steam power plant, petrol and diesel engines |

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| C315 | HEAT TRANSFER LAB |
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Course Outcomes (Cos)

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| C315.1 | Determine the heat transfer rate and coefficient. |
| C315.2 | Determine the thermal conductivity, efficiency and effectiveness. |
| C315.3 | Determine the emissivity and Stefan-Boltzmann constant. |
| C315.4 | Determine critical heat flux and investigate Lambert's cosine law |
| C315.5 | Experiment with Virtual labs and analyze conduction, HT coefficient |
| C315.6 | Experiment with Virtual labs and investigate Lambert's laws |

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| C316 | CAE & CAM LAB |
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Course Outcomes (Cos)

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|---------------|---|
| C316.1 | Experiment with trusses and beams to determine stress, deflection, natural frequencies, harmonic analysis, HT analysis and buckling |
| C316.2 | Create part programmes using FANUC controller |
| C316.3 | Apply G-codes for automated tool path using CAM software |
| C316.4 | Analyze about rapid prototyping machine and to print simple parts |
| C316.5 | Experiment with virtual 3D printing simulation using Vlabs |

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| C317 | Measurements & Metrology lab |
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Course Outcomes (Cos)

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| C317.1 | Demonstrate the calibration experiments with different gauges, transducers, thermocouple and temperature detector |
| C317.2 | Demonstrate the calibration experiments with rotameter, seismic apparatus |
| C317.3 | Demonstrate the calibration experiments with vernier calipers, micrometer, height and dial gauges |
| C317.4 | Analyze various machine tools for their alignment. |
| C317.5 | Measure angular and taper measurements, straightness, surface roughness. |

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| C318 | Artificial Intelligence and Machine Learning Lab |
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Course Outcomes (Cos)

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| C318.1 | At the end of the course, student will be able to apply the knowledge of artificial intelligence and machine learning models along with image classifiers and automatic facial recognition using various software tools. |
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**PROGRAMME: MECHANICAL ENGINEERING
JNTUK UNIVERSITY REGULATION R20
FOURTH YEAR COURSES (I & II SEMESTER)
Course Outcome's (Co's)
IV-I & IV-II**

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|-------------|--|
| C401 | UNCONVENTIONAL MACHINING PROCESSES (PE-3) |
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Course Outcomes (Cos)

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|---------------|---|
| C401.1 | Understand the concepts of modern machining processes |
| C401.2 | Learn the principles of ultrasonic machining |
| C401.3 | Apply the principles and procedure of electro chemical and chemical machining processes |
| C401.4 | Apply the principles and procedure of thermal metal removal processes |
| C401.5 | Illustrate the principles and procedure of electron beam machining, laser beam machining and plasma machining |

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| C402 | PRODUCTION PLANNING AND CONTROL (PE-4) |
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Course Outcomes (Cos)

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|---------------|---|
| C402.1 | To understand the different types of production systems and the internal organization of production planning and control |
| C402.2 | estimate forecasts in the manufacturing and service sectors using selected quantitative and qualitative techniques |
| C402.3 | understands the importance and function of inventory and to be able to apply for its control and management |
| C402.4 | apply routing procedures and differentiate schedule and loading and interpret scheduling policies and aggregate planning. |
| C402.5 | To understand dispatching procedure and applications of computers in production planning and control |

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| C403 | NON DESTRUCTIVE EVALUATION (PE5) |
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Course Outcomes (Cos)

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|---------------|---|
| C403.1 | Understand the concepts of various NDE techniques and the requirements of radiography techniques and safety aspects |
| C403.2 | Interpret the principles and procedure of ultrasonic testing (BL-2) |
| C403.3 | Understand the principles and procedure of Liquid penetration and eddy current testing. |

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| C403.4 | Illustrate the principles and procedure of Magnetic particle testing |
| C403.5 | Interpret the principles and procedure of infrared testing and thermal testing |

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| C404 | ENVIRONMENTAL MANAGEMENT |
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Course Outcomes (Cos)

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|---------------|--|
| C404.1 | Plan and design the water and wastewater systems |
| C404.2 | Identify the source of emissions and select proper control systems |
| C404.3 | Design & estimation of water supply system for a city |
| C404.4 | to get knowledge about various environmental aspects |
| C404.5 | Selection of suitable treatment flow for raw water treatments |

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| C405 | DISASTER MANAGEMENT & MITIGATION |
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Course Outcomes (Cos)

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|---------------|---|
| C405.1 | the application of Disaster Concepts to Management |
| C405.2 | To Understand Definitions and Terminologies used in Disaster Management |
| C405.3 | To Understand Types and Categories of Disasters |
| C405.4 | To Understand the Challenges posed by Disasters |
| C405.5 | To understand Impacts of Disasters Key Skills |

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| C406 | Universal Human Values: Understanding Harmony |
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Course Outcomes (Cos)

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| C406.1 | By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. |
| C406.2 | They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). |
| C406.3 | It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction |

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| C407 | MECHATRONICS LAB |
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Course Outcomes (Cos)

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|----------------|---|
| C407.1 | Understand the Characteristics of LVDT |
| C407.2. | Measure load, displacement and temperature using analogue and digital sensors |
| C407.3 | Develop PLC programs for control of traffic lights, water level, lifts and conveyor belts |
| C407.4 | Simulate and analyze PID controllers for a physical system using MATLAB |
| C407.5 | Develop pneumatic and hydraulic circuits using Automaton studio |

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| C408 | PROJECT WORK |
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Course Outcomes (Cos)

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| C408.1 | On the completion of project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology |
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