

COURSE STRUCTURE & DETAILED SYLLABUS

MECHANICAL ENGINEERING

B. TECH THIRD YEAR FIRST SEMESTER

(Applicable for the batches admitted from 2020-2021)



ACE

Engineering College

Ankushapur(V), Ghatkesar(M), Medchal Malkajgiri (Dist.), Telangana - 501 301.

(An Autonomous Institution, Affiliated to JNTUH ,Hyderabad)



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Ankushapur(V), Ghatkesar(M), Medchal Malkajgiri Dist - 501 301
(Autonomous)

B.TECH. THIRD YEAR FIRST SEMESTER MECHANICAL ENGINEERING COURSE STRUCTURE

III Year				I Semester			
S.No.	Course Type	Course Code	Course Title	Periods Per Week			Credits
				L	T	P	
1	PCC	ME501PC	Dynamics of Machinery	3	1	0	4
2	PCC	ME502PC	Design of Machine Members-I	3	0	0	3
3	PCC	ME503PC	Metrology & Machine Tools	3	0	0	3
4	PCC	ME504PC	Instrumentation and Control Systems	3	0	0	3
5	PCC	ME505PC	Thermal Engineering-II	3	0	0	3
6	PCC	ME506PC	Operations Research	3	0	0	3
7	PCC	ME507PC	Instrumentation and Control Systems Lab	0	0	2	1
8	PCC	ME508PC	Metrology & Machine Tools Lab	0	0	2	1
9	PCC	ME509PC	Kinematics & Dynamics Lab	0	0	2	1
10	*MC	MC509	Intellectual Property Rights	3	0	0	0
11	*MC	MC510ME	Analysis Lab	0	0	3	0
12	*MC	MC511EC	Cyber Security	3	0	0	0
Total				24	1	9	22

Note: *MC = Satisfactory/Unsatisfactory

ME501PC: DYNAMICS OF MACHINERY

B.Tech. III Year I Semester								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
ME501PC	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil			Total Classes: 60			

Prerequisite: Kinematics of Machinery

Course Objectives:

1. To impart the knowledge of principles, operations and to analyze the different types of governors for controlling speed changes caused by changes in the load.
2. To study and understand the principles of gyroscope and its applications.
3. To understand the method of static force analysis and dynamic force analysis in mechanisms while transmitting motion and power.
4. To study the unbalanced forces and analyze the forces acting in different parts of reciprocating and rotating parts of an engine.
5. To determine the natural frequencies of undamped, damped and forced vibrating systems.

Course Outcomes:

Upon Completion of this course, students will be able to:

1. Analyze and design various types of governors and their applications.
2. Apply the gyroscopic principle on aeroplane, ship, four wheel and two-wheel vehicles.
3. Understand various methods of static and dynamic analysis of planar and spatial mechanisms.
4. Understand the causes of rotating and reciprocating unbalance and balancing techniques for rotating/reciprocating masses, in-line, radial and v-engines.
5. Perform detailed analysis of the response of one degree of freedom systems with free and forced vibrations, critical speed of the shaft and simple vibration calculations of rotor systems.

UNIT – I

Precession: Gyroscopes – effect of precession – motion on the stability of moving vehicles such as motorcycle – motorcar – aeroplanes and ships.

Static and Dynamic Force Analysis: Static force analysis of planar mechanisms – Analytical Method – Dynamic Force Analysis – D’Alembert’s principle, Dynamic Analysis of 4-link mechanism, Slider Crank Mechanism.

UNIT – II

Turning Moment Diagram and Flywheels: Engine Force Analysis – Piston Effort, Crank Effort, etc., Inertia Force in Reciprocating Engine – Graphical Method - Turning moment diagram –fluctuation of energy – flywheels and their design - Inertia of connecting rod- inertia force in reciprocating engines – crank effort and torque diagrams.

UNIT – III

Friction: pivots and collars – uniform pressure, uniform wear – friction circle and friction axis: lubricated surfaces – boundary friction – film lubrication. Clutches – Types – Single plate, multi-plate, and cone clutches. **Brakes and Dynamometers:** Types of brakes: Simple block brake, band, and block brake- internal expanding shoe brake-effect of braking of a vehicle. **Dynamometers** – absorption and transmission types. General description and methods of operation.

UNIT – IV

Governors: Types of governors - Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronisms and hunting – stability – effort and power of the governors.

Balancing: Balancing of rotating masses- Primary, Secondary, and higher balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples. Examination of “V” and multi cylinder in-line and radial engines for primary and secondary balancing- locomotive balancing – Hammer blow – Swaying couple – variation of tractive effort.

UNIT – V

Vibrations: Free Vibration of mass attached to vertical spring – Transverse loads – vibrations of beams with concentrated and distributed loads. Dunkerly’s method – Raleigh’s method. Whirling of shafts – critical speed – torsional vibrations – one, two and three rotor systems.

Textbooks:

1. Theory of Machines /S.S.Rattan / Mc Graw Hill.
2. Theory of Machines /Sadhu Singh/ Pearson.

Reference Books:

1. Theory of Machines and Mechanisms/Joseph E. Shigley / Oxford.
2. Theory of Machines / Rao,J.S & R. V. Duggipati/ New Age.

ME502PC: DESIGN OF MACHINE MEMBERS-I

B.Tech. III Year I Semester								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
ME502PC	Core	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil			Total Classes: 60			

Prerequisite: Engineering mechanics, mechanics of solids, manufacturing processes, metallurgy and material science.

Course Objectives:

1. To apply fundamental design practices with regard to material selection, material properties, manufacturing considerations, standards and codes.
2. To understand the general design procedures and principles in the design of machine elements.
3. To study different materials of construction and their properties and factors determining the selection of material for various applications.
4. To determine stresses under different loading conditions.
5. To learn the design procedure of different fasteners, joints, shafts and couplings.

Course Outcomes:

Upon Completion of this course, students will be able to:

1. The student acquires the knowledge about the principles of design, material selection, component behavior subjected to loads, and criteria of failure.
2. Understands the concepts of principal stresses, stress concentration in machine members and fatigue loading.
3. Design on the basis of strength and rigidity and analyze the stresses and strains induced in a machine element.
4. Design keys, cotters and knuckle joints including riveted, bolted and welded joints.
5. Provide alternate design solutions based on requirement.

UNIT – I

Introduction: General considerations in the design of Engineering Materials and their properties – selection – Manufacturing consideration in design. Tolerances and fits –BIS codes of steels.

Design for Static Strength: Simple stresses – Combined stresses – Torsional and Bending stresses– Impact stresses – Stress strain relation – Various theories of failure – Factor of safety – Design for strength and rigidity – preferred numbers. The concept of stiffness in tension, bending, torsion and combined situations.

UNIT - II
Design for Fatigue Strength: Stress concentration–Theoretical stress Concentration factor–Fatigue stress concentration factor- Notch Sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Gerber’s curve– Goodman’s line– Soderberg’s line.
UNIT – III
Riveted, Welded and Bolted Joints: Riveted joints- methods of failure of riveted joints-strength equations-efficiency of riveted joints-eccentrically loaded riveted joints. Welded joints -Design of fillet welds-axial loads-circular fillet welds under bending, torsion. Welded joints under eccentric loading. Bolted joints – Design of bolts with pre-stresses – Design of joints under eccentric loading – locking devices – bolts of uniform strength.
UNIT – IV
Keys, Cotters and Knuckle Joints: Design of keys-stresses in keys-cottered joints-spigot and socket, sleeve and cotter, Gib and cotter joints-Knuckle joints.
UNIT – V
Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code. - Gaskets and seals (stationary & rotary) Shaft Couplings: Rigid couplings – Muff, Split muff and Flange couplings. Flexible couplings – Flange coupling (Modified).
Textbooks: 1. Design of Machine Elements / V. Bhandari / Mc Graw Hill. 2. Machine Design / Jindal / Pearson.
Reference Books: 1. Design of Machine Elements / V. M. Faires / Macmillan. 2. Design of Machine Elements-I / Kannaiah, M.H / New Age.

ME503PC: METROLOGY & MACHINE TOOLS

B.Tech. III Year I Semester								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
ME503PC	Core	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil			Total Classes: 60			
Prerequisite: None								
Course Objectives: The course content enables students to								
<ol style="list-style-type: none"> 1. Acquire the knowledge of Engineering metrology and its practice which is having increasing importance in industry. 2. Specifically make the student to improve applications aspect in the measurements and control of process of manufacture. 3. Impart the fundamental aspects of the metal cutting principles and their application in studying the behavior of various machining processes. 4. Train in knowing the fundamental parts of various machine tools and their kinematic schemes. 5. Discuss various principles of jigs and fixtures which will be used to hold and guide the work pieces and cutting tools in various machine tools. 								
Course Outcomes: At the end of the course, the student would be able to								
<ol style="list-style-type: none"> 1. Identify techniques to minimize the errors in measurement. 2. Identify methods and devices for measurement of length, angle, gear & thread parameters, surface roughness and geometric features of parts. 3. Understand working of lathe, shaper, planer, drilling, milling and grinding machines. 4. Comprehend speed and feed mechanisms of machine tools. 5. Estimate machining times for machining operations on machine tools. 								
UNIT – I								
Metal cutting: Introduction, elements of cutting process – Geometry of single point tools. Chip formation and types of chips. Engine lathe – Principle of working, types of lathe, specifications. Taper turning, – Lathe attachments. Capstan and Turret lathe – Single spindle and multi-spindle automatic lathes – tool layouts.								
UNIT-II								
Drilling and Boring Machines – Principles of working, specifications, types, operations performed; twist drill. Types of Boring machines and applications. Shaping, slotting and planing machines Principles of working – machining time calculations.								

UNIT – III

Milling machines – Principles of working – Types of milling machines – Geometry of milling cutters methods of indexing. Grinding – theory of grinding – classification of grinding machines. Types of abrasives, bonds. Selection of a grinding wheel. Lapping, honing and broaching machines, comparison and Constructional features, machining time calculations.

UNIT-IV

Limits, fits and tolerances- Types of Fits - Unilateral and bilateral tolerance system, hole and shaft basis system. Interchangeability and selective assembly.

Limit Gauges: Taylor’s principle, Design of GO and NO-GO gauges, Measurement of angles using Bevel protractor and Sine bar. Measurement of flatness using straight edges, surface plates, optical flat and auto collimator.

UNIT-V

Surface Roughness Measurement: Roughness, Waviness. CLA, RMS, Rz Values. Methods of measurement of surface finish, Talysurf. Screw thread measurement, Gear measurement; Machine Tool Alignment Tests on lathe, milling and drilling machines. Coordinate Measuring Machines: Types and Applications of CMM.

Text Books:

1. Machine Tool Practices/ Kibbe, John. Neely, T. White, Rolando O. Meyer/ Pearson.
2. Engineering Metrology/ R.K. Jain/ Khanna Publishers.

Reference Books:

1. Principles of Machine Tools, Bhattacharyya A and Sen.G.C / New Central Book Agency.
2. Fundamentals of Dimensional Metrology / Connie Dotson / Thomson.
3. Fundamentals of Metal Machining and Machine Tools / Geoffrey Boothroyd / McGraw Hill.
4. Principles of Engineering Metrology/ Rega Rajendra/ Jaico Publishers.
5. Metrology and Measurement/ Bewoor & Kulkarni/ Tata Mc Graw Hill.

ME504PC: INSTRUMENTATION AND CONTROL SYSTEMS

B.Tech. III year I semester								
Course Code	Category	Hours/Week			Credits	Max Marks		
ME504PC	Core	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil			Total Classes: 60			
Prerequisite: Mathematics-I, Thermodynamics, Basic of Electrical and Electronics Engineering								
Course Objectives:								
<ol style="list-style-type: none"> 1. Understanding the basic characteristic of a typical instrument. 2. Identifying errors and their types that would occur in an instrument. 3. Identifying properties used for evaluating the thermal systems. 4. The concept of transducer and Various types and their characters. 5. Analyze about speed measurement devices and their applications. 								
Course Outcomes:								
<ol style="list-style-type: none"> 1. To identify various elements and their purpose in typical instruments, to identify various errors that would occur in instruments. 2. Analysis of errors so as to determine correction factors for each instrument. 3. To understand static and dynamic characteristics of instrument and should be able to determine loading response time. 4. For given range of displacement should be able to specify transducer, its accurate and loading time of that transducer. 5. Summarize the calibration procedures of various instruments. 								
UNIT- I								
<p>Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional description of measuring instruments – examples. Static and Dynamic performance characteristics– sources of errors. Classification and elimination of errors. Measurement of Displacement: Theory and construction of various transducers to measure displacement – Using Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers; Calibration procedures.</p>								
UNIT – II								
<p>Measurement of Temperature: Various Principles of measurement-Classification: Expansion Type: Bimetallic Strip-Liquid in glass Thermometer; Electrical Resistance Type: Thermistor, Thermocouple, RTD; Radiation Pyrometry: Optical Pyrometer; Changes in Chemical Phase: Fusible Indicators and Liquid crystals. Measurement of Pressure:</p>								

Different principles used- Classification: Manometers, Dead weight pressure gauge Tester (Piston gauge), Bourdon pressure gauges, Bulk modulus pressure gauges, Bellows, Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges, ionization pressure gauges, McLeod pressure gauge.

UNIT – III

Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Magnetic, Cryogenic Fuel level indicators –Bubbler level indicators.

Flow measurement: Rotameter, magnetic, Ultrasonic, Turbine flowmeter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).

Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Non- contact type Stroboscope; Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle- Piezo electric accelerometer.

UNIT – IV

Stress-Strain measurements: Various types of stress and strain measurements –Selection and installation of metallic strain gauges; electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending, compressive and tensile strains – Temperature compensation techniques, Use of strain gauges for measuring torque, Strain gauge Rosettes.

Measurement of Humidity: Moisture content of gases, Sling Psychrometer, Absorption Psychrometer, Dew point meter. Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT-V

Elements of Control Systems: Introduction, Importance – Classification – Open and closed systems- Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems- Transfer functions- First and Second order mechanical systems.

Text Books:

1. Principles of Industrial Instrumentation & Control Systems, - Alavala, - Cengage Learning.
2. Basic Principles – Measurements (Instrumentation) & Control Systems – S. Bhaskar – Anuradha Publications.

Reference Books:

1. Measurement Systems: Applications & design, E. O. Doebelin, TMH.
2. Instrumentation, Measurement & Analysis, B.C. Nakra & K.K. Choudhary, TMH.
3. Experimental Methods for Engineers / Holman.
4. Mechanical and Industrial Measurements / R. K. Jain/ Khanna Publishers.
5. Mechanical Measurements / Sirohi and Radhakrishna / New Age International.

ME505PC: THERMAL ENGINEERING-II

B.Tech. III year I semester								
Course Code	Category	Hours/Week			Credits	Max Marks		
ME505PC	Core	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil			Total Classes: 60			
Prerequisite: Thermodynamics								
Course Objectives:								
<ol style="list-style-type: none"> 1. Study and learn the processes and cycles followed in Thermal Power Plants and Gas turbine plants and components used in the power plants. 2. Gain the knowledge on steam power plants, gas turbine power plants and Jet propulsions, their analyses on fuel and fluidized bed combustion. 3. To apply the laws of Thermodynamics to analyze steam power cycle and to perform analysis of the major components of steam power plants and their applications. 4. To apply the laws of Thermodynamics to analyze gas turbine cycle and to perform analysis of the major components of gas turbine plants and their applications. 5. Understanding the concepts of jet propulsion and rockets and its types with thermodynamic analysis and performance evaluation. 								
Course Outcomes: At the end of the course, the student should be able to								
<ol style="list-style-type: none"> 1. Develop state – space diagrams based on the schematic diagrams of process flow of steam and gas turbine plants. 2. Apply the laws of Thermodynamics to analyze thermodynamic cycles. 3. Differentiate between vapour power cycles and gas power cycles. 4. Infer from property charts and tables and to apply the data for the evaluation of performance parameters of the steam and gas turbine plants. 5. Understand the functionality of major components of steam and gas turbine plants and to do the analysis of these components. 								
UNIT-I								
<p>Steam Power Plant: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating.</p> <p>Boilers – Classification – Working principles with sketches including H.P.Boilers – Mountings and Accessories – Working principles- Boiler horse power, Equivalent Evaporation, Efficiency and Heat balance – Draught- Classification</p>								

– Height of chimney for given draught and discharge- Condition for maximum discharge- Efficiency of chimney.

UNIT-II

Steam Nozzles: Stagnation Properties- Function of nozzle – Applications and Types- Flow through nozzles- Thermodynamic analysis – Assumptions -Velocity of nozzle at exit-Ideal and actual expansion in nozzle- Velocity coefficient- Condition for maximum discharge- Critical pressure ratio- Criteria to decide nozzle shape- Super saturated flow, its effects, Degree of super saturation and Degree of under cooling - Wilson line.

UNIT-III

Steam Turbines: Classification – Impulse turbine; Mechanical details – Velocity diagram – Effect of friction – Power developed, Axial thrust, Blade or diagram efficiency – Condition for maximum efficiency. De-Laval Turbine - its features- Methods to reduce rotor speed-Velocity compounding and Pressure compounding- Velocity and Pressure variation along the flow – Combined velocity diagram for a velocity compounded impulse turbine.

Reaction Turbine: Mechanical details – Principle of operation, Thermodynamic analysis of a stage, Degree of reaction –Velocity diagram – Parson’s reaction turbine – Condition for maximum efficiency.

UNIT-IV

Steam Condensers: Requirements of steam condensing plant – Classification of condensers – Working principle of different types – Vacuum efficiency and Condenser efficiency – Air leakage, sources and its affects, Air pump- Cooling water requirement.

Gas Turbines: Simple gas turbine plant – Ideal cycle, essential components – Parameters of performance – Actual cycle – Regeneration, Inter cooling and Reheating –Closed and Semi-closed cycles – Merits and Demerits- Combustion chambers and turbines of Gas Turbine Plant- Brief Concepts.

UNIT-V

Jet Propulsion: Principle of Operation –Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo jet engines – Needs and Demands met by Turbo jet – Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation – Methods.

Rockets: Application – Working Principle – Classification – Propellant Type – Thrust, Propulsive Efficiency – Specific Impulse – Solid and Liquid propellant Rocket Engines.

Text Books:

1. Thermal Engineering / Mahesh M Rathore/ Mc Graw Hill.

2. Gas Turbines – V. Ganesan /Mc Graw Hill.

Reference Books:

1. Gas Turbine Theory/ Saravanamuttoo, Cohen, Rogers/ Pearson.
2. Fundamentals of Engineering Thermodynamics / Rathakrishnan/ PHI.
3. Thermal Engineering/ Rajput/ Lakshmi Publications.

ME506PC: OPERATIONS RESEARCH

B.Tech. III year I semester								
Course Code	Category	Hours/Week			Credits	Max Marks		
ME506PC	Core	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil			Total Classes: 60			
Prerequisite: None								
Course Objectives:								
<ol style="list-style-type: none"> 1. Understanding the mathematical importance of development of model in a particular optimization model for the issue and solving it. 2. Grasp the methodology of OR problem solving and formulate linear programming problem. 3. Develop formulation skills in transportation models and assignment problems and finding solutions, Understanding of sequencing and replacement theory. 4. Basic understanding of inventory and theory of games. 5. Understand the basics in the field of dynamic programming and waiting lines. 								
Course Outcomes:								
<ol style="list-style-type: none"> 1. Understanding the problem, identifying variables & constants, Formulation of optimization model and applying appropriate optimization technique. 2. Formulate a given simplified description of a suitable real-world problem as a linear programming model and use the simplex method to solve small linear programming models. 3. Solve & interpret transportation models' and assignment problems, solve sequencing and replacement theory. 4. Solve basic game theory and gain knowledge in fundamental concepts in inventory. 5. Formulate and solve waiting lines and dynamic programming problems. 								
UNIT-I								
Development-definition-characteristics and phases-Types of models-Operations Research models- applications.								
Allocation: Linear Programming Problem Formulation-Graphical solution- Simplex method-Artificial variable techniques: Two-phase method, Big-M method.								
UNIT-II								
Transportation problem - Formulation-Optimal solution, unbalanced transportation problem- Degeneracy.								
Assignment problem - Formulation-Optimal solution, - Variants of Assignment problem- Travelling salesman problem.								

UNIT-III

Sequencing- Introduction-Flow-Shop sequencing- n jobs through two machines – n jobs through three machines- Job shop sequencing-two jobs through ‘ m ’ machines

Replacement: Introduction- Replacement of items that deteriorate with time- when money value is not counted and counted- Replacement of items that fail completely- Group Replacement.

UNIT-IV

Theory of Games: Introduction- Terminology- Solution of games with saddle points and without saddle points. 2×2 games- dominance principle- $m \times 2$ & $2 \times n$ games- Graphical method.

Inventory: Introduction- Single item, Deterministic models- purchase inventory models with one price break and multiple price breaks- Stochastic models _ Demand may be discrete variable or continuous variable- single period model and no setup cost.

UNIT-V

Waiting lines: Introduction- Terminology- Single channel- Poisson arrivals and Exponential service times with infinite population.

Dynamic Programming: Introduction- Terminology, Bellman’s principle of optimality- Applications of Dynamic programming- shortest path problem- linear programming problem.

Text Books:

1. Operations Research/ J. K. Sharma4e./ MacMilan.
2. Introduction to OR/ Hillier & Libemann/TMH.

Reference Books:

1. Introduction to OR/Taha/PHI.
2. Operations Research/NVS Raju/SMS Education/3rd Revised Edition.
3. Operations Research /A. M. Natarajan, P.Balasubramaniam, A. Tamilarasi/Pearson Education.
4. Operations Research/ Wagner/ PHI Publications.
5. Operations Research/M.V. Durga Prasad, K.Vijaya Kumar Reddy, J. Suresh Kumar/Cengage Learning.

ME507PC: INSTRUMENTATION AND CONTROL SYSTEMS LAB

B.Tech. III Year I Semester								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
ME507PC	Core	L	T	P	C	CIA	SEE	Total
		-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 30			Total Classes: 30			
Prerequisite: Basic principles of Instrumentation and control systems								
Course Objectives:								
<ol style="list-style-type: none"> 1. Identifying errors and their types that would occur in an instrument. 2. Identifying properties used for evaluating the thermal systems. 								
Course Outcomes: At the end of the course, the student will be able to								
<ol style="list-style-type: none"> 1. Characterize and calibrate measuring devices. 2. Identify and analyze errors in measurement. 3. Analyze measured data using regression analysis. 4. Calibration of Pressure Gauges, temperature, LVDT, capacitive transducer, rotameter. 								
List of Experiments: Minimum of 12 Exercises need to be performed								
<ol style="list-style-type: none"> 1. Calibration of Pressure Gauges. 2. Calibration of transducer for temperature measurement. 3. Study and calibration of LVDT transducer for displacement measurement. 4. Calibration of strain gauge for temperature measurement. 5. Calibration of thermocouple for temperature measurement. 6. Calibration of capacitive transducer for angular displacement. 7. Study and calibration of photo and magnetic speed pickups for the measurement of speed. 8. Calibration of resistance temperature detector for temperature measurement. 9. Study and calibration of a rotameter for flow measurement. 10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads. 11. Study and calibration of McLeod gauge for low pressure. 12. Measurement and control of Pressure of a process using SCADA system. 13. Measurement and control of level in a tank using capacitive transducer with SCADA. 14. Measurement and control of temperature of a process using resistance temperature detector with SCADA. 								

ME508PC: METROLOGY & MACHINE TOOLS LAB

B.Tech. III Year I Semester								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
ME508PC	Core	L	T	P	C	CIA	SEE	Total
		-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 30			Total Classes: 30			
Prerequisite: Theoretical exposure to Metrology and machine tools								
Course Objectives:								
<ol style="list-style-type: none"> 1. To learn the Step turning and taper turning and thread cutting Drilling and Tapping on the lathe machine 2. To the operations of Shaping and Planing and milling 3. To conduct experiments and understand the working of the same. 4. To import practical exposure to the metrology equipment & Machine Tools. 5. To learn the measurement of the Angle and tapers by Bevel protractor, Sine bars, etc. 								
Course Outcomes:								
<ol style="list-style-type: none"> 1. Perform plain turning, step turning and Grooving on a circular rod 2. Perform the step turning and taper turning on a circular rod 3. Perform thread cutting and knurling on a circular C.S rod and using the lathe machine 4. Drill a hole and perform tapping once given work piece. 5. Slotting operation on a given specimen 								
List of Experiments:								
<ol style="list-style-type: none"> 1. Step turning on lathe machine. 2. Taper turning on lathe machine. 3. Thread cutting and knurling on lathe machine (2 exercises). 4. Measurement of cutting forces on lathe. 5. Machining of holes using Drilling and boring machines. 6. Gear cutting on the Milling machine. 7. Grinding of Tool angles using Cylindrical / Surface Grinding. 8. Measurement of lengths, heights, diameters by vernier calipers, micrometers. 9. Measurement of Diameter of bores by internal micrometers and dial bore indicators. 10. Use of gear teeth vernier calipers for checking the chordal addendum and chordal height of the spur gear. 11. Angle and taper measurements by bevel protractor and sine bars. 12. Thread measurement by 2-wire and 3-wire methods. 13. Surface roughness measurement by Tally Surf. 14. Use of mechanical comparator. 								

ME509PC: KINEMATICS & DYNAMICS LAB

B.Tech. III Year I Semester								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
ME509PC	Core	L	T	P	C	CIA	SEE	Total
		-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 30			Total Classes: 30			
<p>Prerequisite: Prerequisites for the graduate-level course are Kinematics, Dynamics, differential equations, motion simulation, displacement, velocity, acceleration, force, torque, power, Newton's motion laws, vibration, Gyroscopic Effect, Cams, Bearings.</p>								
<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. The objective of the lab is to understand the kinematics and dynamics of mechanical elements such as linkages, gears, cams and learn to design such elements to accomplish desired motions or tasks. 2. To inspect the critical speed of shaft under the given load conditions. 3. To understand the gyroscopic effect and couple on motorized gyroscope. 4. To examine the balancing of rotating masses in dynamic balancing machine. 5. To Sketch the characteristic curves of Watt, Porter, Proell and Hartnell governors and motion curves for the given cam follower setup. 								
<p>Course Outcomes:</p> <p>Upon successful completion of this lab, students should be able to:</p> <ol style="list-style-type: none"> 1. Understand types of follower motion and cam mechanism. 2. Analyze forces and torques of components in linkages. 3. Understand static and dynamic balance. 4. Understand forward and inverse kinematics of open-loop mechanisms. 5. Measure vibration parameters in single degree freedom systems. 								
<p>List of Experiments: (A Minimum of 10 experiments are to be conducted)</p> <ol style="list-style-type: none"> 1. To determine the state of balance of machines for primary and secondary forces. 2. To determine the frequency of torsional vibration of a given rod. 3. Determine the effect of varying mass on the centre of sleeve in porter and proell governor. 4. Find the motion of the follower if the given profile of the cam. 5. The balance masses statically and dynamically for single rotating mass systems. 6. Determine the critical speed of a given shaft for different n-conditions. 7. For a simple pendulum determine time period and its natural frequency. 8. For a compound pendulum determine time period and its natural frequency. 								

9. Determine the effect of gyroscope for different motions.
10. Determine time period, amplitude and frequency of undamped free longitudinal vibration of single degree spring mass systems.
11. Determine the pressure distribution of lubricating oil at various load and speed of a Journal bearing.
12. Determine time period, amplitude and frequency of damped free longitudinal vibration of single degree spring mass systems.

***MC509: INTELLECTUAL PROPERTY RIGHTS**

B.Tech. III year I semester								
Course Code	Category	Hours/Week			Credits	Max Marks		
MC509	MC	L	T	P	C	CIA	SEE	Total
		3	0	0	0	0	30	70
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
UNIT-I								
Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.								
UNIT-II								
Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.								
UNIT-III								
Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.								
UNIT-IV								
Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.								
UNIT-V								
New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.								
Text Books & Reference Books:								
<ol style="list-style-type: none"> 1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning. 2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd. 								

***MC510ME: ANALYSIS LAB**

B.Tech. III Year II Semester								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		CIA	SEE	Total
MC511ME	Core	-	-	3	0	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 45			Total Classes: 45			
Course Objectives:								
<p>1. Learn practical application of FEA using the ANSYS software</p> <p>2. Learn the proper use of ANSYS code</p> <p>3. Build computer models or transfer CAD models of structures, products, components, or systems.</p> <p>4. Apply operating loads or other design performance conditions.</p>								
Course Outcomes:								
<p>At the end of this course the student will be able to</p> <p>1. Understand the basics of ANSYS capabilities, terminology and the GUI.</p> <p>2. Know how to perform a complete ANSYS analysis step-by-step.</p> <p>3. Acquire the knowledge in building solid models & meshing, apply loads, solving & reviewing results</p> <p>4. Be in a position to model and analyse for finding stress, temperature distribution etc, with the help of suitable boundary conditions.</p>								
List of Experiments: The following analysis can be performed by using any of the analysis software(s) like ANSYS, ALGOR, NASTRAN, NISA, ABAQUS etc.								
<p>1. STATIC ANALYSIS: Truss and Frame Structures</p> <p>(i) 2-D truss</p> <p>(ii) 3-D truss</p> <p>(iii) Beam analysis</p> <p>2. STATIC ANALYSIS: Two Dimensional Problems and Three Dimensional Problems</p> <p>(i) 2-D structure with various loadings</p> <p>(ii) 2-D structures with different materials</p> <p>(iii) Plate with hole</p> <p>(iv) Axi-Symmetric Component</p> <p>(v) Stepped bar</p> <p>3. DYNAMIC ANALYSIS: Modal and Transient Analyses</p> <p>(i) Modal analysis</p> <p>(ii) Transient Response (spring-mass system)</p> <p>4. NON-STRUCTURAL PROBLEMS</p> <p>(i) Steady State heat transfer</p>								

(ii) Transient heat transfer

LEARNING RESOURCES

REFERENCES:

1. Introduction to Finite elements in Engineering by Chandrupatla• & Belegundu, PHI, 2010.
2. Ansys, " Multiphysics User's Manual"

***MC511EC: CYBER SECURITY**

B.Tech. III year I semester								
Course Code	Category	Hours/Week			Credits	Max Marks		
MC511EC	MC	L	T	P	C	CIA	SEE	Total
		3	0	0	0	0	30	70
Contact Classes:50	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 50			
Prerequisites: Nil								
Course objectives:								
<ol style="list-style-type: none"> 1. To familiarize various types of cyber-attacks and cyber-crimes 2. To give an overview of the cyber laws 3. To study the defensive techniques against these attacks 								
Course Outcomes: The students will be able to understand cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.								
UNIT-I								
Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.								
UNIT-II								
Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.								
UNIT-III								
Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings								

for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT-IV

Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

UNIT-V

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

Cybercrime: Examples and Mini-Cases

Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

Text Books:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

