DEPARTMENT OF MECHANICAL ENGINEERING
A.U. COLLEGE OF ENGINEERING (A), ANDHRA UNIVERSITY, VISAKHAPATNAM

SCHEME AND SYLLABI FOR B.TECH MECHANICAL ENGINEERING
(2019-2020 Academic Year: AICTE)

B.TECH III -YEAR I – SEMESTER

Code No	Course	Credit	Lecture Hrs	Tutorial Hrs	Lab Hrs	Total Contact Hrs/Week	Sessional Marks	Exam Marks	Total Marks
MEC 3101	Dynamics of Machinery	3	4	-	-		30	70	100
MEC 31	Applied Thermodynamics	3	4	-	-		30	70	100
MEC 3103	Fluid Mechanics & Machinery	3	4	-	-		30	70	100
MEC 31	Operations Research	3	4	-	-		30	70	100
MEC 3105	Industrial Engineering & Management	3	4	-	-		30	70	100
MEC 3106	Elective-1	3	4	-	-		30	70	100
MEC 3107	Manufacturing Technolo Lab-I	1.5	-	-	3		50	50	100
MEC 31	Dynamics of Machinery Lab	1.5	-	-	3		50	50	100
MEC 3109	FMM LAB	1.5	-	-	3		50	50	100
	TOTAL	**22.5**	**24**		**9**		**330**	**570**	**900**

B.TECH III -YEAR II – SEMESTER

Code No	Course	Credits	Lecture H	Tutorial H	Lab Hrs	Total Conta Hrs/Week	Sessional Marks	Exam Marks	Total Marks
MEC 3201	Measurements & CN	3	4	-	-		30	70	100
MEC 32	CAD/CAM	3	4	-	-		30	70	100
MEC 3203	Applied Thermodynamics-II	3	4	-	-		30	70	100
MEC 32	Elective-II	3	4	-	-		30	70	100
MEC 3205	Production Planning ar Control	3	4	-	-		30	70	100
MEC 3206	Design of Machine Elements	3	4	-	-		30	70	100
MEC 3207	I. C Engines Lab	1.5	-	-	3		50	50	100
MEC 32	Manufacturing Technology Lab-II	1.5	-	-	3		50	50	100
MEC 3209	CAD/CAM Lab	1.5	-	-	3		50	50	100
	TOTAL	**22.5**	**24**		**9**		**330**	**570**	**900**

Third Year 1st Semester

MEC- 3101 DYNAMICS OF MACHINERY

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70
Examination (Theory): 3hrs. Credits : 3

SYLLABUS:

Gyroscopic Couple and Precessional Motion: Precessional and angular motion- gyroscopic couple- effect of gyroscopic couple on an aero plane and on a naval ship, stability of a four wheel vehicle moving in a curved path, stability of a two-wheel vehicle taking a turn.

Cams: Classification of followers and cams- Definitions- Motions of the follower- Uniform velocity- Simple harmonic motion- Uniform acceleration and retardation- Displacement- Velocity and acceleration diagrams. Construction of cam profiles- Cam with knife edged follower and roller follower- Cams with specified contours- Tangent cam with roller follower- Circular arc cam with flat faced follower.

Toothed gearing: Classification of toothed wheels, technical terms, conditions for constant velocity ratio of toothed wheels- Law of gearing- Velocity of sliding of teeth, forms of teeth- Length of contact, arc of contact, interference in involute gears, minimum number of teeth required on pinion to avoid interference- Methods of avoiding interference- Helical gears, Spiral gears- Efficiency of spiral gears.

Gear Trains: Types of gear trains- Simple, compound, reverted and epicyclic gear trains- Velocity ratio of epicyclic gear train- Tabular method- Algebraic method- Torques and tooth loads in epicyclic gear trains.

Balancing of Rotating and Reciprocating Masses: Balancing of a single rotating mass in thesame plane and by two masses in different planes, balancing of several masses revolving in the same plane- Balancing of several masses revolving in different planes- Primary and secondary unbalanced forces of reciprocating masses, Partial balancing of unbalanced primary forces in a reciprocating engine, Partial balancing of locomotives- Effect of partial balancing of reciprocating parts of two cylinder locomotives- Variation of tractive force, Swaying couple and hammer blow- Balancing of primary and secondary forces in multi cylinder in- line engines- Direct and reverse cranks- Balancing of V-Engines.

Vibrations: Definitions- Types of vibrations- Natural frequencies of free longitudinal vibrations of systems having single degree of freedom- Equilibrium method- Energy method and Rayleghy's method. Frequency of damped vibration and forced vibration with damping- Magnification factor or dynamic magnifier.

Transverse and Torsional Vibrations: Natural frequency of free transverse vibrations due topoint load and uniformly distributed load acting over a simply supported shaft- Transverse vibrations for a shaft subjected to number of point loads- Energy method- Dunkerley's method,Critical speed of a shaft. Natural frequency of free torsional vibrations- Free torsional vibrations of single rotor system, two rotor system, three rotor system and gear system.

Text Book:

1. Theory of Machines by R.S.Khurmi&J.K.Gupta.

Reference books:

1. Theory of Machines by Thomas Bevan.
2. Theory of Machines by S.S. Rattan.

MEC- 3102 APPLIED THERMODYNAMICS-I

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS:

Properties of Pure Substance: Definition of pure substance, phase change of a pure substance,p-T (Pressure-Temperature) diagram for a pure substance, p-V-T(Pressure-Volume- Temperature) surface, phase change terminology and definitions, property Diagrams in common use, Formation of steam, Important terms relating to steam formation, Thermodynamic properties of steam and steam tables, External work done during evaporation,Internal latent heat, Internal energy of steam, Entropy of water, Entropy of evaporation, Entropy of wet steam, Entropy of superheated steam, Enthalpy-Entropy (h-s) charts for Mollier diagram, Determination of dryness fraction-Tank or bucket calorimeter, throttling calorimeter,separating and throttling calorimeter.

Gases and Vapour Mixtures and Vapor Powe r Cycles : Introduction, Daltons law and Gibbs-Dalton law, Volumetric Analysis of gas mixtures, Apparent molecular weight and gas constant, specific heats of gas mixture, Adaibatic mixing of perfect gases, Gas and vapour mixtures.Vapor power cycle- Rankine cycle- Reheat cycle- Regenerative cycle- Thermodynamic variables effecting efficiency and output of Rankine and Regenerative cycles- Improvements of efficiency, Binary vapor power cycle.

Steam Nozzles: Type of nozzles- Flowthrough nozzles- Condition for maximum discharge- Nozzle efficiency- Super saturated flow in nozzles- Relationship between area velocity and pressure in nozzle flow- Steam injectors.

Steam Turbines: Classification of steam turbines- Impulse turbine and reaction turbine- Compounding in turbines- Velocity diagrams in impulse and reaction turbines- Degree of reaction- Condition for maximum efficiency of reaction turbines- Effect of friction on turbines constructional features governing of turbines.

Condensers: Classification of condenser- Jet, Evaporative and surface condensers- Vacuum and its measurement- Vacuum efficiency- Sources of air leakage in condensers- Condenser efficiency- Daltons law of partial pressures- Determination of mass of cooling water- Air pumps.

Refrigeration: Bell Colemen cycle, Vapor compression cycle- effect of suction and condensing temperature on cycle performance, Properties of common refrigerants, Vapor absorption system, Electrolux refrigerator. Principles of psychrometry and Air conditioning - Psychrometric terms, psychrometric process, air conditioning systems.

Text Books:

1. A Treatise on Heat Engineering by Vasandhani and Kumar.
2. Applied Thermodynamics-II by R. Yadav.
3. Fundamentals of Engineering Thermodynamics by E. Radhakrishna, PHI.

References:

1. Thermal Engineering, by R. K. Rajput.
2. Fluid Flow Machines, by M.S. GovindaRao, Tata McGraw Hill publishing company Ltd.
3. Refrigeration and Air-conditioning, by C.P.Arora and Domokundwar.
4. Thermal Science and Engineering by D.S. Kumar, S.K. Kataria and Sons
5. Refrigeration and Air-conditioning, by AhamadulAmeen, PHI.

MEC-3103 FLUID MECHANICS & MACHINERY

(Effective from the batch admitted during 2019-2020 -AICTE)

Periods/week : 4 Th. Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits:3

Properties of fluids- Introduction-Viscosity- Pressure and its measurement , Absolute, Gauge, Atmospheric and Vacuum pressure – Manometers, Simple manometers, Differential manometers. Hydrostatic forces on surfaces - Total Pressure and Pressure Centre - Vertical, Horizontal, inclined and Curved plane surfaces submerged in liquid- Buoyancy and Floatation. **Fluid Kinematics & Fluid Dynamics** : Types of fluid flow - Continuity equation - Velocity potential function and Stream Function - Types of Motion, Linear Translation, Linear deformation, Angular deformation, Rotation, Vorticity and circulation-Vortex flow, forced and Free Vortex – Equation of Motion- Euler's equation - Bernoulli's equation and its applications- Venturimeter, Orifice Meter, Pitot tube-Momentum Equation-Momentum of momentum Equation- Free Liquid Jet- Flow net analysis.

Viscous Flow: Couette flow- Plane Couette flow, Favourable pressure gradient and adverse pressure gradient-Power absorbed in Viscous Flow- Flow through pipes- Hagen Poiseulle flow- Fannigs friction factor- Darcy's Weisbach friction factor- Loss of head due to friction in pipes, Minor Losses and Major losses - Flow through branched pipes- Power transmission through pipes- Two dimensional viscous flow: Navier -Stokes equations and solutions- Order of magnitude analysis-Boundary layer equations.

Laminar Boundary Layer: Definition- Laminar Boundary Layer-Laminar Sub layer- Boundary Layer thickness-Displacement thickness, Momentum thickness and Energy thickness-Momentum integral equation- Flow over a flat plate.

Turbulent Boundary Layer: Laminar- Turbulent transition- Momentum equations and Renold's stresses- Fully developed turbulent flow through a pipe- Turbulent boundary layer ona flat plate-Laminar sub-layer- Boundary layer separation and control.

Dimensional and Modeling Analysis : Fundamental and derived dimensions- Dimensionless groups- Rayleigh method- Buckingham π-theorem- Model Analysis - Types of similarity-Geometric, Kinematic and Dynamic similarities- Dimensionless numbers- Modal Laws- Hydraulic diameter.

Hydraulic Turbines: Classification- Pelton wheel-Reaction turbines-Inward and outward radial flow reaction turbines- Francis turbine –Axial flow reaction turbine-Kaplan turbine- Draft tube-Types-Theory-and efficiency of draft tube.

Reciprocating Pumps : Main pats-Classification-Velocity and acceleration variation in suction and delivery pipes due to piston acceleration-Effect of variation of velocity on friction in suction and delivery pipes-Effect of acceleration in suction and delivery pipes onindicator diagram-Effect of Friction-Maximum speed of Reciprocating Pump

Text Book:

1. Fluid Mechanics and Hydraulic Machines, by R. K. Bansal, Laxmi publications.
2. Fluid Mechanics, by A.K. Mohanty, Prentice Hall of India Pvt.Ltd.

References:

1. Fluid Mechanics and Fluid Power Engineering by Dr. D.S. Kumar, S.K. Kataria &Sons.
2. Foundations of Fluid Mechanics, by Yuan, Prentice Hall of India.
3. Fluid Mechanics and its Applications, by S. K.Gupta and A.K.Gupta, Tata McGraw Hill,New Delhi.
4. Fluid Mechanics and Hydraulic Machines by R. K. Rajput, S.Chand & Co.
5. Fluid Mechanics by Kothandaraman and Rudramoorthy.

MEC- 3104 OPERATIONS RESEARCH

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS:

Development: Definition, Characteristics and phase of Scientific Method, Types of models. General methods for solving operations research models.

Allocation: Introduction to linear programming formulation, graphical solution, Simplex method, Artificial variable technique, Duality theory and Dual simplex method.

Transportation Problem: Formulation optimal solution. Unbalanced transportation problems, Degeneracy. Assignment problem, Formulation optimal solution, Variations i.e., Non-square (m*n) matrix restrictions.

Sequencing: Introduction, Terminology, notations and assumptions, problems with n-jobs and two machines, optimal sequence algorithm, problems with n-jobs and three machines, problems with n-jobs and m-machines, graphic solutions. Travelling salesman problem.

Waiting lines: Single channel Poisson arrivals, Exponential service times, Unrestricted queue with infinite population and finite population models; Single channel Poisson arrivals, Exponential service times with infinite population and restricted queue.

Replacement: Introduction, Replacement of items that deteriorate with time - value of money unchanging and changing, Replacement of items that fail completely.

Theory of games: Introduction, Two-person zero-sum games, The Maximum -Minimax principle, Games without saddle points - Mixed Strategies, 2xn and mx2 Games - Graphical solutions, Dominance property, Use of L.P. to games, Algebraic solutions to rectangular games.

Inventory: Introduction, inventory costs, Independent demand systems: Deterministic models - Fixed order size systems - Economic order quantity (EOQ) - Single items, back ordering, Quantity discounts (all units quantity discounts), Batch - type production systems: Economic production quantity - Single items, Economic production quantity multiple items. Fixed order interval systems: Economic order interval (EOI) - Single items, Economic order interval (EOI) - Multiple items.

Network Analysis: Network definitions, Minimum spanning tree algorithm, Shortest root problem, Maximum flow model. Elements of project scheduling by CPM and PERT.

Text Books:

1. Operation Research, by TAHA (PHI)
2. Operations Research Methods and Problems, by M.Sasiene, A.Yespal and L.Friedman.(John Wiely)
3. Operation Research by S.D.Sharma.(KedarnadhRamnadh& Co.,)
4. Operation Research by R.Pannerselvam, (PHI)

MEC- 3105 INDUSTRIAL ENGINEERING AND MANAGEMENT

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits: 3

SYLLABUS:

Concepts of Industrial Management: Principles of management- Growth of management thought, Functions of management, Principles of organization, Types of organization and committees.

Introduction to personnel management- Functions, Motivation, Theories of motivation, Hawthrone studies, Discipline in industry, Promotion, Transfer, lay off and discharge, Labour turnover.

Industrial relations- Trade unions, Industrial disputes, Strikes, Lock-out, Picketing, Gherao, Settlement of industrial disputes, Collective bargaining, Industrial dispute act 1947 and factories act 1948.

Production Planning and Control: Types of productions, Production cycle, Product design and development, Process planning, Forecasting, Loading, Scheduling, Dispatching, Routing, Progress, Control, Simple problems.

Plant Layout: Economics of plant location, Rural Vs Suburban sites, Types of layouts, Types of building, Travel chart technique, Assembly line balancing simple problems.

Materials Handling- Principles, Concept of unit load, Containerization, Pelletization, Selection of material handling equipment, Applications of belt conveyors, Cranes, Forklift trucks in industry.

Plant Maintenance: Objectives and types.

Work Study: Concept of productivity, Method Study - Basic steps in method study, Process charts, Diagrams, Models and Templates, Principles of motion economy, Micro motion study, Therbligs, SIMO chart. Work Measurement - Stop watch procedure of time study, Performance rating, allowances, Work sampling, Simple problems.

Materials Management: Introduction, Purchasing, Objectives of purchasing department, Buying techniques, Purchase procedure, Stores and material control, Receipt and issue of materials, Store records. Inventory Control, EOQ model(Simple problems).

Quality Control - Control charts of variables and attributes (Use of formulae only). Single and Double sampling plans.

Text Book:

1. Industrial Engineering Management, by Dr. O. P .Khanna.

References:

1. Principles of Management by Koontz &Donnel.
2. Production and Operations Management by Everette Adam & Ronald Ebert.
3. Operations Management by John McClain & Joseph Thames.
4.. Industrial Engineering and Production Management by Telsay, S. Chand & Co.

ELECTIVE-1 MEC- 3106A FINITE ELEMENT ANALYSIS

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70
Examination (Theory): 3hrs. Credits :3

SYLLABUS:

Fundamental Concepts: Introduction, Historical background, Outline of presentation, General procedure for FEA, Stresses and Equilibrium, Boundary conditions, Strain- Displacement relations, Stress-Strain relations, Plane stress, Plane strain problems, Temperature effects, Potentialenergy and equilibrium. The Rayleigh-Ritz method, Hamilton'sprinciple.Galerkin's method, Saint Venant's principle.

One-dimensional Problems: Introduction, Finite element modeling, Coordinates and Shape functions. The potential energy approach.The Galerkin approach, Assembly of the global stiffness matrix- mass matrix and load vector, Treatment of boundary conditions, Quadratic shape functions, Temperature effects. Trusses: Introduction, Plane trusses, Three-dimensional trusses, Assembly of global stiffness matrix for the Banded and Skyline solutions.

Two-dimensional Problems Using Constant Strain Triangles: Introduction, Finite element modeling, Constant strain triangle, In plane and Bending, problem modeling and boundary conditions.

Axisymmetric Solids Subjected to Axisymmetric Loading : Introduction, Axisymmetric formulation, Finite element modeling, Triangular element, Problem modeling and boundary conditions.

Two-dimensional Isoparametric Elements and Numerical Integration: Introduction, The four-node quadrilateral, Numerical integration, requirements, h-refinement and p-refinement, Higher-order elements, Convergence

Beams and Frames: Introduction, Finite element formulation, Load vector, Boundary considerations, Shear force and bending moment, Beams on elastic supports, Plane frames.

Text Book:

1. Introduction to Finite Elements in Engineering, by Tirupathi R. Chandrupatla, Ashok D.Belegundu (chapters 1 to 8 only).

References:

1. Introduction to Finite Element Method, by S.S.Rao
2. Finite Element Method, by O.C. Zienkiewicz.
3. Concepts and Applications of Finite Element Analysis, by Robert D. Cook.
4. Introduction to Finite Element Method, by J.N.Reddy.

ELECTIVE-1 MEC- 3106B WORK STUDY

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70
Examination (Theory): 3hrs. Credits :3

SYLLABUS

Introduction to work study: Scientific management – Productivity - Advantages of work study to management, Supervisors and workers.

Method Study: Introduction - Process charts, Critical Examination, Identification of key activities on process charts, Diagrams and Templates, Therbligs, Micro motion analysis, Memo motion study. Developing new method - Job survey report writing.

Principles of Motion Economy: Related to human body, work place, equipment.

Work Measurement: Work measurement techniques – Rating - Measuring the job – Allowances - Standard time - Synthetic data - Analytical estimating – PMTS ,Work factor, MTM, Activity sampling, Its applications.

Job Evaluation, Techniques of job evaluation - Merit rating - Incentive plans.

Ergonomics: Basics of Ergonomics**,** Anthropometry.

Text Books:

1. Introduction to Work Study - International LabourOrganisation.
2. Elements of Work Study and Ergonomics by Dalela et al, Standard Publications.

References:

1. Motion and Time Study, by Barnes, John Wiely.

ELECTIVE-1 ME 3106C ADVANCED FOUNDRY AND WELDING TECHNOLOGY

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70
Examination (Theory): 3hrs. Credits :3

SYLLABUS:

Moulding: Development of metal castings- Materials for moulding- Foundry sand control- Different types of cores- Core making processes- Materials for core making- Moulding and core making machines. Recent developments in core mould making- Cold set process- Investment process- Shell moulding- Hot box method- Shaw process. Vacuum moulding- moulding for mass production.

Melting and Solidification: Furnaces used in foundry for melting ferrous and nonferrous metals- principals of operation of cupola and charge calculations. Family of cast irons- Production of malleable and S.G. Irons- Methods of alloying and inoculants and their effects

on the structure and properties of cast iron. Principles of Solidification: Nucleation- Crystal growth- Morphology and structure of cast metals and alloys- Pure metals- Single phase alloys and eutectics. Solidification in sand and chill moulds.

Foundry Mechanization: Layout for ferrous and nonferrous foundries- Description of equipment used for mechanization- Sand conditioners- Conveyors- Cranes- Equipment for handling moulds, Cores and molten metal- Knock out of moulds- Fettling equipment.

Special Welding Processes: Resistance welding processes- Spot, Seam, Projection, Flash butt welding - Machine cycle for resistance welding- Parameters in resistance welding- Electrodes for resistance welding – Solid State Welding: Cold welding – Forge welding - Ultrasonic welding Diffusion welding – Radiation welding: Laser Beam Welding, Electron Beam Welding – Automatic welding systems.

Weldability of Metals: Factors influencing weldability of metals- Welding of Cast steels, Carbon steels, Stainless steels and Cast iron. Weldability of Cu and its alloys, Al and its alloys- Ti and its alloys- Mg and its alloys- Temperature changes in welding and their effects on mechanical properties. Absorption of gases by welds and their effects- Residual stresses and distortion- Heat treatment of welded parts.

Welding Joints, Weld Symbols and Joint Design principles: Types of joints – types of welds – Variants of joints and weld types - Welding symbols – principles of weld joint design and evolving of good weld designs.

Text Books:

1. Foundry Technology, by Jain P.L.
2. Welding Engineering and Technology, by R.S. Parmar.

References:

1. Foundry Engineering, by Agarwal.
2. Foundry Engineering, by Taylor F. & Others.
3. Principles of Metal Castings, by Heine & Others.
4. Modern Welding Technology, by H.B. Cary.
5. Welding Technology, by Koenisburger.
6. Welding Metallurgy, S.Kou, 2ndedition, John Wiley and Sons, New York, NY (2003).

MEC -3107 MANUFACTURING TECHNOLOGY LAB-I

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 3 Lab Ses. : 50 Exam : 50

Examination (Theory): 3hrs. Credits : 1.5

LIST OF EXPERIMENTS:

Use of basic tools and operations of the following trades.

S. No.	Trade	No. of exercises
1.	Foundry	3
2.	Welding	2
3.	Lathe Step and taper turning	1

	Thread cutting Offset turning	1 1
4.	Milling	1 (Spur gear)
5.	Shaper	1

1. Cylindrical grinding, Surface grinding, Planing, Slotting and Capstan lathe (only demonstration in one class for the entire batch of students).
7. Dissembling and assembling of *
   i. Machine Tool (Lathe)
   ii. I.C. engine
   iii. Pump
   iv. Gear box

* Not for examination.

MEC- 3108 DYNAMICS OF MACHINERY LAB

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 3 Lab Ses. : 50 Exam : 50

Examination (Theory): 3hrs. Credits :1.5

List of Experiments:

1. Determination of inertia of the given flywheel and connecting rod.
2. Determination of modulus of rigidity of the given wire with torsion pendulum.
3. Verification of laws of balancing.
4. a) Determination of ratios of angular speeds of shafts connected by Hooke's joint.
   b) Determination of the ratio of times and ram velocities of Withworth quick return motionmechanism.
5. To draw curves of slider displacement and crank angle and linear velocities w.r.t. time for a slider crank mechanism and compare with theoretical values.
6. To determine the relation of gyroscopic couple and compare with the theoretical values
7. To determine the radius of gyration of given bar by using bifilar and Trifiller suspension.
8. Find the CG of a connecting rod using free vibration techniques.
9. To determine natural frequency of free torsional vibrations of single rotor system.
10. Find the Natural frequency of the free un-damped vibrations of equivalent spring mass system.
11. Find the Natural frequency of the free damped vibrations of equivalent spring mass system.
12. Find the Natural frequency of the forced damped vibrations of equivalent spring mass system.
13. Find the Natural frequency of the forced un-damped vibrations of equivalent spring mass system.
14. Experiments with piezo-electric pick-up, Inductive pick-ups. Determination of characteristics-Displacement, Velocity and Acceleration.
15. Calibration of the given pressure gauge.
16. Calibration of Rotameter.
17. Calibration of Strain Gauges
    a) Full Bridge
    b) Half Bridge
    c) Quarter Bridge

MEC- 3109 FMM LAB

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 3 Lab Ses. : 50 Exam : 50
Examination (Practical): 3hrs. Credits: 1.5

List of Experiments:

1. Calibration of flow meters,
    a. Venturi meter
    b. Orifice meter
    c. Nozzle meter
2. Determination of coefficient of discharge for
    a. small orifice
    b. cylindrical mouth piece
3. Finding coefficient of discharge for
    a. rectangular notch
    b. triangular notch
    c. trapezoidal notch
4. To draw the performance characteristics of C.F. pump.
5. To find the specific speed of
    a. Pelton turbine
    b. Francis turbine
6. To draw the characteristic curves for reciprocating pump.
7. To draw the pressure distribution and finding coefficient of drag for
    a. a bluff body
    b. an Aero foil
    c. To draw the characteristic curves for the hydraulic ram

Third Year 2nd Semester

MEC- 3201 MEASUREMENTS & CNC

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70
Examination (Theory): 3hrs. Credits :3

Automatic screw lathes, Multi spindle automatic lathes, Turret lathes, Numerical control, NC operation, Coordinate system, Data input devices, Data storage, Programme editing, Machining centres, Turning centres, Vertical turning centres, Milling centres, Advantages of NC, Computers & NC, CNC, DNC, CNC part programming: Designation of co-ordinate axes for CNC machines, Functions of machine control units, Tape format, Manual part programming and computer assisted part programming (using APT language). Exercises involving simple contours and positioning.

ISO system of limits, Fits and Tolerances, Interchangeability, Plain limit gauges, Measurementof screw threads, major diameters, Minor diameters and effective diameter, Pitch, Limit gauges for internal and external threads, Measurement of spur gears, pitch, profile, lead, backlash, tooth thickness.

Tool maker's microscope, Straightness measurement, Slip gauges, Twisted strip mechanical comparator, Optical lever comparator, Optical projector, Electric comparator, Pneumatic comparator, Squareness testing, Optical bevel protractor, Sine bar, Angle gauges, Precision level, Autocollimeter, Angle dekkor, Optical dividing heads and rotary tables, Flatness measurement, Roundness measurement. Co-ordinate measuring machines.

Surface texture: Parameters, sampling length, Specification, Stylus instruments for surface roughness measurement. Acceptance tests on machine tools: Lathe, Milling machine, Radial drill, Laser equipment.

Text Books:

1. Process & Materials of Manufacture, R.A.Lindberg, 4th edition, Prentice-Hall of India, New Delhi.
2. A Text Book of Engineering Metrology, I.C.Gupta, Dhanpat Rai & Sons, Delhi.
3. CNC and Computer Aided Manufacturing, T.K.Kundra, P.N.Rao & N.K.Tewari, Tata McGraw-Hill Publishing Company Ltd, Delhi.

References:

1. A.S.T.M.E., Hand book of Industrial Metrology, Prentice-Hall of India, New Delhi.
2. A.S.T.M.E., Hand book of Manufacturing Engineering.
3. Manufacturing Processes & Materials for Engineers, L.E.Doyle & others,Prentice-Hall of India, New Delhi.

MEC- 3202 CAD/CAM

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th — Ses. : 30 Exam : 70
Examination (Theory): 3hrs. — Credits :3

SYLLABUS:

COMPUTER AIDED DESIGN

Fundamentals of CAD - Introduction - The design process - Application of computers for design - Operating systems - Hardware in CAD: The design work station - I/O Devices - CADsystem configuration - Creating database for manufacturing - Benefits of CAD.

Interactive Computer Graphics - Graphic display devices- Graphics system- Graphics standards - Graphical user interface- Transformation systems- 2D and 3D transformations - Linear transformation- windowing – clipping - Geometric Modeling - Modeling Techniques - Wire frame Modeling - Surface Modeling - 3 D Solid Modeling.

Introduction to Finite Element Analysis – Steps of FEM for solving physical problem, CAD techniques to finite element data preparation- Automatic mesh generation- Presentation of results - CAD applications of FEM.

COMPUTER AIDED MANUFACTURING

Group technology: Merits & demerits, Organization, Classification and Coding systems, Cellular manufacturing.

Computer aided process planning : Introduction to process planning, Methods of process planning, Computer aided process planning, CAPP systems

Computer aided material handling: Robots: Structure and operation of Robots, robot sensorsand applications. Automatic conveyor systems.Automated guided vehicles.

Computer aided inspection and quality control: Quality assurance and quality control. Contact and Non-contact inspection -Coordinate measuring machine.

FMS & CIMS: Building blocks of Flexible Manufacturing Systems (FMS), Machiningsystems of FMS, Tool management systems, Advantages of FMS, Computer integrated manufacturing

systems (CIMS).

Text Books:

1. CAD/CAM- Computer Aided Design & Manufacturing, by M.D.Groover&E.W.Zimmer.
2. Computer Aided Design and Manufacturing, by Dr.Sadhu Singh, Khanna Publishers.

References:

1. Computer Aided Design in Mechanical Engineering, by V.Rama Murthy.
2. Elements of Computer Aided Design & Manufacturing, by Y.C.Pao.
3. Computer Aided Kinetics for Machine Design, by D.L.Ryan.
4. Computer Aided Design and Manufacturing, by C.B.Besant&C.W.K.Lui.
5. Computer-Aided Analysis & Design by S. Ghosal, Prentice Hall of India.
6. CAD/CAM/CIM by Radhakrishna, New age international.
7. Computer Integrated Design and Manufacturing, by David D.Bedworth, MarkR.Henderson& Philip M.Wolfe, McGraw-Hill Book Company, Singapore.
8. Computer Aided Manufacturing, by P.N.Rao, N.K.Tewari&T.K.Kundra, Tata McGraw-Hill publishing company Ltd, NewtDelhi.

MEC 3203 APPLIED THERMODYNAMICS-II

(Effective from the batch admitted during 2019-2020 AICTE)

Periods/week : 4 Th — Ses. : 30 Exam : 70
Examination (Theory): 3hrs. — Credits :3

SYLLABUS:

I.C. engines: classification-comparison of two stroke and four stroke engines- comparison of S.I. and C.I. engines-Air cycles-Otto, Diesel, Dual, Stirling, Ericson and Atkinson cycles and their analysis-Valve timing and port timing diagrams- Efficiencies- air standard efficiency,indicated thermal efficiency, brake thermal efficiency, mechanical efficiency, volumetric efficiency and relative efficiency-Testing and performances of I.C. engines-Basic principles of carburetion and fuel injection.

Combustion in I.C. Engines: S.I. engines- Normal combustion and abnormal combustion-Importance of flame speed and effect of engine variables-types of abnormal combustion pre- ignition and knock, Fuel requirements and fuel rating, anti-knock additions- Combustion chamber requirements and Types of combustion chamber- Design principles of combustion chambers-C.I. engines- Stages of combustion- Delay period and its importance- effect of engine variables, diesel knock, suction compression and combustion induced turbulence, open and divided combustion chambers.

Reciprocating and Rotary Compressors: Reciprocating compressors-effect of clearance in compressors, volumetric efficiency-single stage and multi stage compressors-effect of inter cooling in multi stage compressors-Vane type blower-centrifugal compressor- Adiabatic efficiency-Diffuser- Axial flow compressors- Velocity diagrams, degree of reaction, performance characteristics.

Gas Turbines: Simple gas turbine plant- Ideal cycle, closed cycle and open cycle for gas turbines-Efficiency, work ratio and optimum pressure ratio for simple gas turbine cycle- Parameters of performance- Actual cycle, regeneration, Inter-cooling and reheating, closed andsemi-closed cycle-Jet propulsion and Rockets.

Nuclear powe r plants: Classification of reactors-Thermal utilization-Fuels, Fuel moderator and coolant, Control and safety rods, Special properties of structural materials required, Induced radio-activity-Gas cooled reactors, Radiation hazards and shielding- Radio active waste disposal.

Direct Energy Conversions and non conventional energy sources: Solar Energy- Introduction, Solar radiation, Solar collectors, Energy storage-Wind Energy- Wind mills- Thermo Electric- MHD.

Text Books:

1. A Treatise on Heat Engineering by Vasandhani and Kumar.
2. Applied Thermodynamics-II by R. Yadav.

References:

1. Thermal Engineering, by R.K.Rajput.
2. I.C. Engines, by Mathur and Nehata.
3. Gas Turbines, by Cohen and Rogers.
4. Fluid Flow Machines, by M.S. GovindaRao, Tata McGraw Hill publishing company Ltd.
5. I.C. Engines by V. Ganesan.
6. Power Plant Engineering, P.K.Nag
7. Non ConventionalEnergy Sources, G.D.Rai
8. Internal Combustion Engines by R.K. Mohanty, Standard Book House

.

ELECTIVE-II MEC- 3204A AUTOMOBILE ENGINEERING

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th — Ses. : 30 Exam : 70
Examination (Theory): 3hrs. — Credits :3

SYLLABUS:

Introduction: Definition of automobile, Automobile Layout, Chassis and Transmission: Introduction to Drive Train: Clutch, Gearbox, Hook's Joint, Propeller /Drive Shaft, Slip Joint, Final Drive and Differential, Front and Rear Axles, Wheels and Tires, Control systems: Introduction to Steering, and Brakes. Electrical system: Introduction to Starting System, Ignition, dynamo/alternator, cut-out and wiring. Automobile Body: Parts and Stream lining, Automobile types: Front, Rear and Four wheel drive and Automotive materials.

Engine (Powe r Plant): Multi cylinder engine parts, Classification: 'In- line' and 'V' type, Multi-Valve Engines, VCR Engines, Super Charging/Turbo charging, Air filters, Fuel Systems: Petrol Engines: Carbureted and MPFI, Ignition Systems: Conventional and Electronic, Diesel Engines: Conventional, CRDI, and Duel Fuel engines., Performance, Combustion and Exhaust Emissions, Air pollution and their control: EGR and Catalytic Converters, EURO/Bharat Stage Norms: I, II, III, IV and V., Manifolds and Mufflers, EngineCooling and Lubrication.

Clutch: Necessity, Clutch Assembly: Construction and Working Principle, Types: Single and Multiple Plates, Free-Play, Fluid coupling/Torque converter, Clutch Troubles and Remedies.

Gearbox: Necessity of Transmission and Transaxle, Construction and Working Principle, Selector Mechanism, Types: Sliding mesh, Constant mesh, Synchromesh, and Epicyclical. Three, Four and Five- Speed Gearbox, Overdrive, Automatic Gearbox, Gearbox Troubles and Remedies.

Drive shaft and Final Drive: Drive Shaft: Constructional Features: Universal/Hooks Joints, Slip Joint, and Working Principle., Types of Propeller shafts, Final drive and Differential:

Necessity, Constructional Features and Working Principle., Front/Rear Axles: Constructional Features and Types of Rear Axle Floating, Wheels: Disc and Drum type, Tires: Tire Construction, Tube and Tubeless Tires, Radial Tires, Tire specification, Tire rotation and Tire Maintenance.

Suspension System and Vehicle Control: Coil and Leaf Springs, Shock absorbers, Wheel alignment: Kingpin angle, Caster, Camber, Toe- in, and Toe-out., Necessity of vehicle control, Steering Mechanism and its Elements: Steering gear box and its types, Steering gear ratio, Constant Velocity Joints and linkages. Power Steering, Brake system: Necessity, Parking and Power Brakes, Parts and Working Principle of Mechanical, Air and. Hydraulic Brakes: Mater and Wheel cylinder, Properties of Brake Fluids, Brake Diagnostics and Service: Brake Bleeding, Anti- lock Braking System, Automobile Accessories and Tips for Safe Driving.

Electrical and Electronic Systems: Basics of Electrical/Electronic Systems: Battery, Starting system, Charging System, Lighting and Signaling System, A/C Electrical System, Electronic Engine Management system, Automotive Embedded Systems: Vehicle Security System and Working Principle of Computer Sensors: Temperature, Flow, Cam, knock, and Oxygen, and ECU/ ECM.

Trouble shooting and Maintenance: Engine and Vehicle Troubles: Diagnostic Information: Symptom descriptions and their Causes and Remedies, Periodic, Preventive and Break down Maintenance: Engine tuning, Fuel and Air filters, Lubricants, Maintenance of Battery and Electrical/Electronic System, and Tires. The Motor Vehicle Act (India).

Introduction to Electric and Hybrid vehicles : Performance and emission characteristics of electric and hybrid vehicles

Text Books:

1. Automotive Mechanics (10/e) - William H. Crouse and Donald L. Anglin, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-059054-0
2. Automobile Engineering – KK Jain/ RB Asthana, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-044529-X
3. Internal Combustion Engines and Air Pollution- E.F. Obert, Harper & Row International Publishers Inc., ISBN: 0-06-350561-4

Reference Books:

1. Automotive Mechanics – S. Srinivasan, Tata McGraw-Hill Publishing companyLimited, ISBN: 0-07-044941-6
2. Internal Combustion Engines – Heywood, John, B. McGraw-Hill Publications Limited.
3. Automotive Engines- S Srinivasan, Tata McGraw-Hill Publishing Company Limited,ISBN: 0-07-040265-5

ELECTIVE-II MEC- 3204B MECHANICAL VIBRATIONS

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70
Examination (Theory): 3hrs. Credits :3

SYLLABUS:

Single degree freedom systems -Introduction - Single degree freedom systems- free and forced vibrations - Damping classification and damped systems .

Two degree freedom systems - Free, forced damped and undamped motions - Use of influence coefficients, Matrix methods and Lagrange's equations - Phenomenon of beat - Dynamic absorbers – Applications.

Transient (Shock) vibrations as applied to single and two degree freedom systems - Use of mathematics and graphical techniques in the analysis (superposition integral, Laplace transformations, phase plane techniques).

Multi degree freedom systems - Free and forced motions in longitudinal, torsional and lateral modes - damped and undamped, critical speeds of rotors.

Continuous systems - free and forced vibrations of string, bars and beams - Principle of orthogonality Classical and energy methodsby Rayleigh, Ritz and Gelerkin.

References:

1. Mechanical Vibrations/G.K.Groover/Nem Chand and Bros
2. Mechanical Vibrations / SS Rao/ Pearson/ 2009, Ed 4
3. Mechanical Vibrations by Den Hartog.
4 Mechanical Vibrations by R.Venkatachalam
5.Mechanical Vibrations/Schaum Series/ McGraw Hill
6. Vibration Problems in Engineering by Timoshenko and Young.
7. Mechanical Vibrations/Debabrata Nag/Wiley
8. Mechanical Vibrations and Noise engineering/ A.G.Ambekar/ PHI

ELECTIVE-II MEC- 3204C RELIABILITY ENGINEERING

(Effective from the batch admitted during 2019-2020 AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70
Examination (Theory): 3hrs. Credits :3

SYLLABUS:

Introduction: Concepts of quality and reliability, a brief history, terms, definitions, reliability function, MTTF, Hazard rate function, bath tub curve, conditional reliability.

Constant failure rate models: Exponential reliability, failure modes, failure modes with exponentialdistribution, applications, two parameter exponential distribution, Poisson process.

Time dependent failure models: Weibull distribution, burn-in screening for Weibull, three parameter Weibull distribution, Normal and Lognormal distributions

Reliability of systems: Series, parallel configurations, combined systems, k-out-of-n systems, complex configurations, common failure modes, minimal cuts and minimal paths.

State dependent systems: Markov analysis, load sharing, standby systems, degraded systems

Physical reliability models: Static models- random stress and random strength, dynamic models- periodic models, random loads.

Design for reliability: Reliability specification, Lifecycle costs, reliability allocation, design methods, failure analysis, FTA.

Reliability testing: Life testing, burn-in testing, acceptance testing-binomial acceptancetesting.

Reliability growth testing: Reliability growth process, idealized growth curve, Duane growth model.

Text Book:

1. Introduction to Reliability and Maintenance engineering by Charles E Ebeling, Tata McGrawhill, India.

References:

1. Introduction to Reliability Engineering by E.E. Lewis, John Wiley& Sons,NewYork
2. Reliability based design by S.S.Rao, McGraw-Hill, New York

MEC- 3205 PRODUCTION PLANNING AND CONTROL

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS:

Introduction : Definition – Objectives of production Planning and Control – Functions of production planning and control – Types of production – Organization of production planning and control department.

Forecasting : Importance – Types of forecasting– Forecasting techniques – qualitativemethods and quantitative methods.

Inventory management : Functions of inventories – relevant inventory costs – EOQ model – Inventory control systems – ABC analysis – VED analysis

Material Requirement Planning, Bill of material, MRP II, Master Production Scheduling.

Aggregate planning,: Chase planning, Expediting, controlling aspects.

Routing : Definition – Routing procedure –Route sheets — Factors affecting routing,procedure – Difference with loading

Scheduling: Policies – Types of scheduling- Forward and Backward Scheduling – Gantt Charts – Flow shop Scheduling – n jobs and 2 machines, n jobs and 3 machines – Job shop Scheduling – 2 jobs and n machines – Line of Balance.

Dispatching : Activities of dispatcher – Dispatching procedure – follow up – priority rulesfor dispatching jobs.

Applications of computer in production planning and control.

Text Books:

1. Elements of Production Planning and Control / Samuel Eilon.

2. Modern Production/ operation managements / Baffa&RakeshSarin

References:

1. Operations Management – S.N. Chary.
2. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller.
4. Production Control A Quantitative Approach / John E. Biegel.
5. Operations Management / Joseph Monks.

MEC- 3206 DESIGN OF MACHINE ELEMENTS

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS:

Introduction to Mechanical engineering design: traditional design methods, different design models, Problem formulation, Design considerations, engineering materials and processes andtheir selection, BIS designation of steels, Mechanical properties, Load determination, manufacturing considerations in design.

Design against static loads: Modes of failure, Factory of safety, Axial, bending and torsional stresses, Stress concentration factors. Static failure theories.

Fluctuations and fatigue stresses, Soderberg, Goodman and modified Goodman diagrams, fatigue failure, design consideration in fatigue

Threaded and welded joints: forms of threads, basic types of screw fastenings, ISO metric screw threads, eccentrically loaded bolted joints, Torque requirement for bolt tightening, Fluctuations loads on bolted joints, fasteners, Joints with combined stresses. Power screws, Force analysis. Collar friction, Differential and compound screws design. Types and strength of weld joints subjected to bending and fluctuating loads, cotter and knuckle joints, welded joints, different types welded joints and their design aspects, welding inspection

Shafts, keys and couplings: shafts design on strength basis, torsional rigidity basis, Design of hollow shafts, flexible shafts, ASME codes for shafts, Keys and cotter design, Flat, square keys, Splines, Rigid and flange couplings, Flexible couplings

Spring Design: classification and spring materials, Spring end formation, Design of helical compression springs, helical extension springs, torsion springs, laminated springs, Protective coatings, Equalized stress in spring leaves. Multi - leaf springs. Surge in springs, Nipping andshot peening.

Text Books:

1. Design of Machine Elements by V.B.Bhandari, TMH Publishing Co. Ltd., New Delhi

References:

1. Machine Design by Jain, Khanna Publications.
2. Machine Design by Pandya and Shaw, Charotar publications
3. Machine design , an integrated approach by R.L.Norton, 2nd edition, Pearson Education

MEC- 3207 I. C ENGINES LAB

((Effective from the batch admitted during 2019-2020 AICTE)

Periods/week : 3 Lab Ses. : 50 Exam : 50

Examination (Practical): 3hrs. Credits : 1.5

List of Experiments:

1. Study and valve timing diagrams for four-stroke and study & PTD of two-stroke engines.
2. Determination of volumetric efficiency of the given air compressor by (i) plate orifice method and (ii) tank capacity method.
3. a) Determination of flash and fire points and
4. b) Canradsons carbon residue test.
5. Determination of calorific value of flues (solid, liquid and gaseous) by Bomb calorimeter/Gas calorimeter.
6. Determination of the kinematic and absolute viscosity of the given sample oils.
7. Load test and smoke test on I.C. Engines.
8. Morse test on multi-cylinder engine.
9. Heat balance sheet on I.C. Engines.
10. Study of multi-cylinder engines and determination of its firing order.
11. Calculations of efficiencies of the given air compressor.

MEC- 3208 MANUFACTURING TECHNOLOGY LAB-II

(Effective from the batch admitted during 2019-2020 AICTE)

Periods/week : 3 Lab Ses. : 50 Exam : 50

Examination (Theory): 3hrs. Credits :1.5

LIST OF EXPERIMENTS:

1. Experiments on Lathe to establish the following curves
   a) Depth of cut Vs Cutting force.
   b) Feed Vs Cutting force.
   c) Cutting speed Vs Cutting force.
2. Grinding of single point cutting tool as per given specifications (to check the tool angles).
3. Study of chip formations on shaping machine (with lead sample).
4. Torque measurement on drilling/milling machine.
5. Effect of speed and feed on surface roughness.
6. Measurement of cutting tool temperature in turning.
7. Sieve analysis to evaluate G.F.No.

8. Moisture and clay content test.
9. Green compression and shear test.
10. Shatter Index & Hardness Testing

MEC- 3209 CAD/CAM LAB

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 3 Lab Ses. : 50 Exam : 50

Examination (Theory): 3hrs. Credits :1.5

CAD experiments:

1. Initiating the graphics package; Setting the paper size, space; setting the limits, units; useof snap and grid commands.
2. Drawing of primitives (line, arc, circle, ellipse, triangle etc.)
3. 3D GEOMETRIC MODELING: Creation of 3D Models, Wire Frame, Surface, Solid modeling Techniques Using CAD Packages–CSG, B-Rep Approaches in Solid Modeling Feature Based Modeling Technique–Assembly–Detailing Exposureto Industrial Components – Application of GD&T
4. Drawing a flange.
5. Drawing a Bushing assembly.
6. Dimensioning the drawing and adding text.
7. Setting the layers and application of the layers.
8. Isometric and orthographic projections.
9. Viewing in Three dimensions.
10. Removal of hidden lines - Shading and rendering.

CAM experiments:

1. Preparation of manual part programming for CNC turning/Milling.
2. Part programming preparation through AutoCAD.
3. APT part programming for 2D - contour.
4. Machining of one job on CNC machine tool.
5. Robot programming through Teaching Box method.
6. Robot programming through computer.