

**Indira Gandhi University, Meerpur, Rewari**  
**SCHEME OF STUDIES AND EXAMINATION**  
**B.TECH. (Mechanical)**  
**SEMESTER 5<sup>th</sup> and 6<sup>th</sup>**



**Scheme effective from 2019-20**

**INDIRA GANDHI UNIVERSITY, MEERPUR, REWARI**  
**SCHEME OF STUDIES & EXAMINATIONS**  
**B.Tech. 3<sup>rd</sup> YEAR MECHANICAL ENGINEERING, SEMESTER- V**

Course	Course Title	Teaching schedule				Marks For class work	Marks for Examination		Total Marks	Duration of Exam
		L	T	P	Total		Theory	Practical		
ME-301	Dynamics Of Machines	3	1	-	4	50	100	-	150	3
ME-303	Mechanical Machine Design-1	3	2	-	5	50	100	-	150	4
ME-305	Fluid Machine	3	1	-	4	50	100	-	150	3
ME-307	Internal Combustion Engines & Gas Turbines	3	1	-	4	50	100	-	150	3
ME-309	Manufacturing Technology –II	3	1	-	4	50	100	-	150	3
ME-311	Applied Numerical Technique & Computing	3	-	-	3	50	100	-	150	3
ME-313	Dynamics Of Mechanics Lab	-	-	2	2	25	-	25	50	3
ME-315	Fluid Machine Lab	-	-	2	2	25	-	25	50	3
ME-317	Internal Combustion Engines & Gas Turbines Lab	-	-	2	2	25	-	25	50	3
ME-319	Manufacturing Technology –II Lab	-	-	2	2	25	-	25	50	3
ME-321	Applied Numerical Technique & Computing Lab	-	-	2	2	50	-	-	50	-
ME-323	Practical Training Viva-Voce	-	-	2	2	-	-	-	-	-
	Total	18	6	12	36	450	600	100	1150	

**Note:**

- 1) Students will be allowed to use non-programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
- 2) Assessment of Practical Training-I, undergone at the end of IV semester, will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the industry. According to performance letter grades A, B, C, F are to be awarded. A student who is awarded 'F' grade is required to repeat Practical Training.

## ME- 301 DYNAMICS OF MACHINES

L T P  
3 1 -

Sessional : 50 Marks  
Theory : 100 Marks  
Total : 150 Marks  
Duration of Exam : 3 Hrs.

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

### Section A

Static and Dynamic Force Analysis : Static force analysis of planer mechanisms, dynamic force analysis including inertia and frictional forces of planer mechanisms.

Dynamics of Reciprocating Engines : engine types, indicator diagrams, gas forces, equivalent masses, inertia forces, bearing loads in a single cylinder engine, crankshaft torque, engine shaking forces.

### Section B

Balancing of Rotating Components : static balance, dynamic balance, balancing of rotating masses, two plane balancing, graphical and analytical methods, balancing of rotors, balancing machines, field balancing.

Balancing of Reciprocating Parts : Balancing of single cylinder engine, balancing of multi cylinder; inline, radial and V type engines, firing order.

### Section C

Governors : introduction, types of governors, characteristics of centrifugal governors, gravity controlled and spring controlled centrifugal governors, hunting of centrifugal governors, inertia governors.

Dynamometers : types of dynamometers, Prony brake, rope brake and band brake dynamometers, belt transmission dynamometer, torsion dynamometer, hydraulic dynamometer.

### Section D

Gyroscope : gyroscopes, gyroscopic forces and couples, gyroscopic stabilization, ship stabilization, stability of four wheel and two wheel vehicles moving on curved paths.

### Text Books:

1. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok kumar Mallik, Third Edition Affiliated East-West Press.
2. Theory of Machine: S.S. Rattan, McGraw Hill Higher Education.

### Reference Books:

1. Mechanism and Machine Theory: J.S. Rao and R.V. Duddipati, New age International.
2. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition Mc Graw Hill, Inc

## ME- 303 MECHANICAL MACHINE DESIGN -I

L     T     P  
3     2     -

Sessional     : 50 Marks  
Theory         : 100 Marks  
Total           : 150 Marks  
Duration of Exam : 4 hrs.

**Note: 1.** Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

2. The paper setter will be required to mention in the note of the question paper that the use of following Design Data book is permitted:

- (i) Design Data Handbook (In SI and Metric Units) for Mechanical Engineers by Mahadevan
- (ii) Design Data Book PSG College of Technology Coimbatore

### Section A

Design Philosophy: Problem identification- problem statement, specifications, constraints, Feasibility study- technical feasibility, economic & financial feasibility, societal & environmental feasibility, Generation of solution field (solution variants), Brain storming, Preliminary design, Selection of best possible solution, Detailed design, Selection of Fits and tolerances and analysis of dimensional chains.

Selection of Materials: Classification of Engg. Materials, Mechanical properties of the commonly used engg. Materials, hardness, strength parameters with reference to stress-strain diagram, Factor of safety.

### Section B

Mechanical Joints: ISO Metric Screw Threads, Bolted joints in tension, Eccentrically loaded bolted joints in shear and under combined stresses, Design of power screws, Design of various types of welding joints under different static load conditions.

Riveted Joints, Cotter & Knuckle Joints: Design of various types of riveted joints under different static loading conditions, eccentrically loaded riveted joints, design of cotter and knuckle joints.

### Section C

Belt rope and chain drives: Design of belt drives, Flat & V-belt drives, Condition for Transmission of max. Power, Selection of belt, design of rope drives, design of chain drives with sprockets.

Keys, Couplings & Flywheel: Design of Keys – Flat, Kennedy Keys, Splines, Couplings design – Rigid & Flexible coupling, turning Moment diagram, coefficient of fluctuation of energy and speed, design of flywheel – solid disk & rimmed flywheels.

### Section D

Clutches: Various types of clutches in use, Design of friction clutches – Disc. Multidisc, Cone & Centrifugal, Torque transmitting capacity.

Brakes: Various types of Brakes, Self energizing condition of brakes, Design of shoe brakes – Internal & external expanding, band brakes, Thermal Considerations in brake designing.

#### Text Books:

1. Mechanical Engg. Design - First Metric Editions: Joseph Edward Shigley-MGH, New York.
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.
3. PSG Design Data Book

#### Reference Books :

1. Engineering design – George Dieter, MGH, New York.
2. Product Design and Manufacturing , A.K.Chitale and R.C.Gupta, PHI.
3. Machine Design An Integrated Approach: Robert L.Norton, Addison Wesley.
4. Machine Design : S.G. Kulkarni - Tata MacGraw Hill.
5. Design of machine elements-C S Sharma, Kamlesh Purohit, PHI.

L T 3 1 P

Sessional : 50 Marks  
Theory : 100 Marks  
Total : 150 Marks  
Duration of Exam : 3 Hrs.

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

### **Section A**

Impact of free jets: Impulse – momentum principle, jet impingement - on a stationary flat plate, inclined plate and a hinged plate, at the center of a stationary vane, on a moving flat plate, inclined plate, a moving vane and a series of vanes, Jet striking tangentially at the tip of a stationary vane and moving vane(s), jet propulsion of ships. Problems

Impulse Turbines: Classification – impulse and reaction turbines, water wheels, component parts, construction, operation and governing mechanism of a Pelton wheel, work done, effective head, available head and efficiency of a Pelton wheel, design aspects, speed ratio, flow ratio, jet ratio, number of jets, number of buckets and working proportions, Performance Characteristics, governing of impulse turbines. Problems

### **Section B**

Francis Turbines: Component parts, construction and operation of a Francis turbine, governing mechanism, work done by the turbine runner, working proportions and design parameters, slow, medium and fast runners, degree of reaction, inward/outward flow reaction turbines, Performance Characteristics, Problems.

Propeller and Kaplan turbines: Component parts, construction and operation of a Propeller, Kaplan turbine, differences between the Francis and Kaplan turbines, draft tube - its function and different forms, Performance Characteristics, Governing of reaction turbine, Introduction to new types of turbine, Deriaz ( Diagonal ), Bulb, Tubular turbines, Problems.

### **Section C**

Dimensional Analysis and Model Similitude: Dimensional homogeneity, Rayleigh's method and Buckingham's  $\Pi$ -theorem, model studies and similitude, dimensionless numbers and their significance. Unit quantities, specific speed and model relationships for turbines, scale effect, cavitations – its causes, harmful effects and prevention, Thomas cavitation factor, permissible installation height, Problems.

Centrifugal Pumps: Classification, velocity vector diagrams and work done, manometric efficiency, vane shape, head capacity relationship and pump losses, pressure rise in impeller, minimum starting speed, design considerations, multi-stage pumps. Similarity relations and specific speed, net positive suction head, cavitation and maximum suction lift, performance characteristics. Brief introduction to axial flow, mixed flow and submersible pumps, Problems.

### **Section D**

Reciprocating Pumps: Construction and operational details, discharge coefficient, volumetric efficiency and slip, work and power input, effect of acceleration and friction on indicator diagram (pressure – stroke length plot), separation, air vessels and their utility, rate of flow into or from the air vessel, maximum speed of the rotating crank, characteristic curves, centrifugal vs reciprocating pumps, brief introduction to screw, gear, vane and radial piston pumps, Problems.

Hydraulic systems: Function, construction and operation of Hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic lift and hydraulic press, Fluid coupling and torque converter, Hydraulic ram, Problems.

### **Text Books :**

Hydraulics & Fluid Mechanics – Modi & Seth, Pub. - Standard Book House, N.Delhi  
Hydraulic Machines – Jagdish Lal, Metropolitan

Fluid Mechanics and Hydraulic Machines – S S Rattan, Khanna Publishers

Introduction to Fluid Mechanics and Fluid Machines – S K Som and G Biswas, Tata McGraw Hill

Fluid Mechanics and Fluid Power Engineering – D S Kumar, S K Kataria and Sons

**ME- 307 INTERNAL COMBUSTION ENGINES & GAS TURBINES**

L T 3 1 P  
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Sessional : 50 Marks  
Theory : 100 Marks  
Total : 150 Marks  
Duration of Exam : 3 Hrs.

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

**Section A**

Air Standard Cycles: Internal and external combustion engines; classification of I.C. Engines, Cycles of operation in four stroke and two stroke I.C. Engines, Wankel Engines, Assumptions made in air standard cycle; Otto cycle; diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles; sterling and Ericsson cycles; air standard efficiency, specific work output, specific weight; work ratio; mean effective pressure; deviation of actual engine cycle from ideal cycle. Problems.

Carburetion, fuel Injection and Ignition systems: Mixture requirements for various operating conditions in S.I. Engines; elementary carburetor, Requirements of a diesel injection system; types of inject systems; petrol injection, Requirements of ignition system; types of ignition systems ignition timing; spark plugs. Problems.

**Section B**

Combustion in I.C. Engines : S.I. engines; Ignition limits; stages of combustion in S.I. Engines; Ignition lag; velocity of flame propagation; detonation; effects of engine variables on detonation; theories of detonation; octane rating of fuels; pre-ignition; S.I. engine combustion chambers, Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines, Cetane rating; C.I. engine combustion chambers. Lubrication and Cooling Systems: Functions of a lubricating system, Types of lubrication system; mist, wet sump and dry sump systems; properties of lubricating oil; SAE rating of lubricants, engine performance and lubrication, Necessity of engine cooling; disadvantages of overcooling; cooling systems; air-cooling, water cooling; radiators.

**Section C**

Engine Testing and Performance: Performance parameters: BHP, IHP, mechanical efficiency, brake mean effective pressure and indicative mean effective pressure, torque, volumetric efficiency; specific fuel consumption (BSFC, ISFC), thermal efficiency; heat balance; Basic engine measurements; fuel and air consumption, brake power, indicated power and friction power, heat lost to coolant and exhaust gases; performance curves. Problems. Air pollution from I.C. Engine and Its remedies: Pollutants from S.I. and C.I. Engines, Methods of emission control; alternative fuels for I.C. Engines; the current scenario on the pollution front.

**Section D**

Rotary Compressors: Root and vane blowers; Static and total head values; Centrifugal compressors- Velocity diagrams, slip factor, ratio of compression, pressure coefficient, pre-whirl; Axial flow compressor- Degree of reaction, polytropic efficiency, surging, choking and stalling, performance characteristics, Problems.

Gas Turbines: Brayton cycle; Components of a gas turbine plant; open and closed types of gas turbine plants; Optimum pressure ratio; Improvements of the basic gas turbine cycle; multi stage compression with inter-cooling; multi stage expansion with reheating between stages; exhaust gas heat exchanger, Applications of gas turbines. Problems.

- Text Books:**
1. Internal Combustion Engines –V. Ganesan, Pub.-Tata McGraw-Hill.
  2. Gas Turbines - V. Ganesan, Pub.- Tata McGraw Hill.
  3. Engineering fundamental of the I.C.Engine – Willard W. Pulkrabek Pub.-PHI,India

**Reference Books:**

1. Internal Combustion Engines & Air pollution- Obert E.F, Pub.-Hopper & Row Pub., New York
2. Internal Combustion Engines Fundamentals- John B. Heywood, Pub.-McGraw Hill, New York
3. Fundamentals of Internal Combustion Engines-H.N. Gupta, PHI, New Delhi

L	T	P
3	1	-

Sessional	: 50 Marks
Theory	: 100 Marks
Total	: 150 Marks
Duration of Exam	: 3 Hrs

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

### **Section A**

**Mechanism of Metal Cutting:** Deformation of metal during machining, nomenclature of lathe, milling tools, mechanics of chip formation, built-up edges, mechanics of orthogonal and oblique cutting, Merchant cutting force circle and shear angle relationship in orthogonal cutting, factors affecting tool forces. Cutting speed, feed and depth of cut, surface finish. Temperature distribution at tool chip interface. Numerical on cutting forces and Merchant circle.

**Cutting Tool Materials & Cutting Fluids:** Characteristics of tool materials, various types of cutting tool materials, coated tools, cutting tool selection, Types of tool wear, tool life, factors governing tool life, Purpose and types of cutting fluids, basic actions of cutting fluids, effect of cutting fluid on tool life, selections of cutting fluid.

### **Section B**

**Unconventional Machining Processes:** Abrasive jet machining: Principles, applications, process parameters. Ultrasonic machining: Principles, applications, analysis of process parameters. Electro-chemical machining and grinding: Principles, classifications, choice of electrolytes, applications. Electric discharge machining: Principles, selection of tools materials and dielectric fluid. Electron beam machining: Generation of electron beam, relative merits and demerits. Laser beam machining: Principles and applications.

**Jigs & Fixtures:** Introduction, location and location devices, clamping and clamping devices, Drill Jigs, Milling Fixtures.

### **Section C**

**Numerical Control of Machine Tools;** Introduction, Numerical Control & its growth, NC Machines tools, Axes of NC Machines, Classification of NC System, CNC, DNC and Machining Centre. Machine Control unit, NC tools & Tool changer.

**Manual Part Programming;** coordinate, Feed, Speed & Tool, Preparation & Miscellaneous functions, Examples of two axes part programming for Turning and Milling Operations.

### **Section D**

**Group Technology;** Definition and concept, Group and Family, working of group technology, Stages for Adopting Group Technology, Advantages of Group Technology.

**Component Classification and Coding, Personnel and Group Technology, Planning the introduction of Group Technology, Group Technology layout.**

### **Text Books**

1. Manufacturing Technology – Vol. - 2, P.N. Rao, T.M.H, New Delhi
2. Computer Aided Manufacturing: S Kumar & B Kant Khan, Satya Prakashan, New Delhi

### **Reference Books**

1. Principles of Machine Tools – G.C. Sen & A. Bhattacharya, Tata McGraw Hill, New Delhi
2. Manufacturing Engg.& Tech, Kalpakian, Serope Addison -Wisly Publishing Co. New York.
3. Modern Machining Processes: P.C. Pandey & H.S. Shan, T.M.H. Company, New Delhi
4. Text Book of Production Engineering: P.C. Sharma, S.Chand & Sons.
5. Production Engineering by KC Jain & AK Chilate, PHI, New Delhi

## ME – 311 APPLIED NUMERICAL TECHNIQUES AND COMPUTING

L T P  
3 - -

Sessional marks : 50  
Theory marks : 100  
Total marks : 150  
Duration of exam : 3 hrs

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

### Section A

**ERRORS IN NUMERICAL CALCULATIONS** Introduction, Numbers and their accuracy, Absolute, relative and percentage errors and their analysis, General error formula.

**INTERPOLATION AND CURVE FITTING** Taylor series and calculation of functions, Introduction to interpolation, Lagrange approximation, Newton Polynomials, Chebyshev Polynomials, Least squares line, curve fitting, Interpolation by spline functions.

### Section B

**NUMERICAL DIFFERENTIATION AND INTEGRATION** Approximating the derivative, Numerical differentiation formulas, Introduction to Numerical quadrature, Newton-Cotes formula, Gauss-Jordan Quadrature. **SOLUTION OF NONLINEAR EQUATIONS** Bracketing methods for locating a root, Initial approximations and convergence criteria, Newton-Raphson and Secant methods, Solution of problems through a structural programming language such as C or Pascal.

### Section C

**SOLUTION OF LINEAR SYSTEMS** Direct Methods, Gaussian elimination and pivoting, Matrix inversion, LU factorization, Iterative methods for linear systems, Solution of problems through a structured programming language such as C or Pascal.

**EIGEN VALUE PROBLEMS** Jacobi, Givens' and Householder's methods for symmetric matrices, Rutishauser method for general matrices, Power and inverse power methods.

### Section D

**SOLUTION OF DIFFERENTIAL EQUATIONS** Introduction to differential equations, Initial value problems, Euler's methods, Heun's method, Runge-Kutta methods, Taylor series method, Predictor-Corrector methods, Systems of differential equations, Boundary value problems, Finite-difference method, Solution of problems through a structured programming language such as C or Pascal.

**PARTIAL DIFFERENTIAL EQUATIONS, EIGENVALUES AND EIGENVECTORS** Solution of hyperbolic, parabolic and elliptic equations, The eigenvalue problem, The power method and the Jacobi's method for eigen value problems, Solution of problems through a structural programming language such as C or Pascal.

### Text Books:

1. Numerical Methods for Mathematics, Science and Engineering by John H. Mathews, PHI New Delhi.
2. Applied Numerical Methods – Carnahan, B.H., Luther, H.A. and Wilkes, J.O., Pub.- J. Wiley, New York

### Reference Books

1. Numerical Solution of Differential Equations, by M.K. Jain, Published by Wiley Eastern, New York.
2. Introductory Methods of Numerical Analysis by S.D. Sastry, Published by Prentice Hall of India.
3. Numerical Methods – Hornbeck, R.W. , Pub.- Prentice Hall, Englewood Cliffs, N.J.



L T P  
- - 2

Sessional : 25 Marks  
Practical : 25 Marks  
Total : 50Marks  
Duration of Exam : 3 hrs.

**List of Experiments :**

1. To perform experiment on Watt and Porter Governors to prepare performance characteristic Curves, and to find stability & sensitivity.
2. To perform experiment on Proell Governor to prepare performance characteristic curves, and to find stability & sensitivity.
3. To perform experiment on Hartnell Governor to prepare performance characteristic Curves, and to find stability & sensitivity.
4. To study gyroscopic effects through models.
5. To determine gyroscopic couple on Motorized Gyroscope.
6. To perform the experiment for static balancing on static balancing machine.
7. To perform the experiment for dynamic balancing on dynamic balancing machine.
8. Determine the moment of inertial of connecting rod by compound pendulum method and trilinear suspension pendulum.

- Note :**
1. Ten experiments are to be performed in the Semester.
  2. At least seven experiments should be performed from the above list. Remaining three experiments should be performed as designed & set by the concerned Institution as per the scope of the syllabus.

## ME- 315 FLUID MACHINES LAB.

L T P  
- - 2

Sessional : 25 Marks  
Practical : 25 Marks  
Total : 50 Marks  
Duration of Exam.: 3 Hrs.

### List of Experiments :

1. To study the constructional details of a Pelton turbine and draw its fluid flow circuit.
2. To draw the following performance characteristics of Pelton turbine-constant head, constant-speed and constant efficiency curves.
3. To study the constructional details of a Francis turbine and draw its fluid flow circuit.
4. To draw the constant head, constant speed and constant efficiency performance characteristics of Francis turbine.
5. To study the construction details of a Kaplan turbine and draw its fluid flow circuit.
6. To draw the constant head, speed and efficiency curves for a Kaplan turbine.
7. To study the constructional details of a Centrifugal Pump and draw its characteristic curves.
8. To study the constructional details of a Reciprocating Pump and draw its characteristics curves.
9. To study the construction details of a Gear oil pump and its performance curves.
10. To study the constructional details of a Hydraulic Ram and determine its various efficiencies..
11. To study the constructional details of a Centrifugal compressor.
12. To study the model of Hydro power plant and draw its layout.

**NOTE :**

1. At least ten experiments are to be performed in the Semester.
2. At least seven experiments should be performed from the above list.  
Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

**ME- 317 I.C. ENGINES & GAS TURBINES LAB**

L T - P	Sessional	: 25 Marks
- 2	Practical	: 25 Marks
	Total	: 50 Marks
	Duration of Exam.	: 3 Hrs.

**List of Experiments :**

1. To study the constructional details & working principles of two-stroke/ four stroke petrol engine.
2. To study the constructional detail & working of two-stroke/ four stroke diesel engine.
3. Analysis of exhaust gases from single cylinder/multi cylinder diesel/petrol engine by Orsat Apparatus.
4. To prepare heat balance sheet on multi-cylinder diesel engine/petrol engine.
5. To find the indicated horse power (IHP ) on multi-cylinder petrol engine/diesel engine by Morse Test.
6. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) bhp, ihp, fhp, vs speed ( ii) volumetric efficiency & indicated specific fuel consumption vs speed.
7. To find fhp of a multi-cylinder diesel engine/petrol engine by Willian's line method & by motoring method.
8. To perform constant speed performance test on a single cylinder/multi-cylinder diesel engine & draw curves of (i) bhp vs fuel rate, air rate and A/F and (ii) bhp vs mep, mech efficiency & sfc.
9. To measure CO & Hydrocarbons in the exhaust of 2- stroke / 4-stroke petrol engine.
10. To find intensity of smoke from a single cylinder / multi-cylinder diesel engine.
11. To draw the scavenging characteristic curves of single cylinder petrol engine.
12. To study the effects of secondary air flow on bhp, sfc, Mech. Efficiency & emission of a two-stroke petrol engine.

**NOTE:**

1. At least ten experiments are to be performed in the Semester.
2. At least seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

## ME- 319 MANUFACTURING TECHNOLOGY –II LAB.

L	T	P
-	-	2

Sessional marks	:	25
Practical marks	:	25
Total marks	:	50
Duration of exam	:	3 hrs

### List of Experiments:

- 1 Study and Practice of Orthogonal & Oblique Cutting on a Lathe.
- 2 Machining time calculation and comparison with actual machining time while cylindrical turning on a Lathe and finding out cutting efficiency.
- 3 Study of Tool Life while Milling a component on the Milling Machine.
- 4 Study of Tool Wear of a cutting tool while Drilling on a Drilling Machine.
- 5 Study of Speed, Feed, Tool, Preparatory (Geometric) and Miscellaneous functions for N. C part programming.
- 6 Part Programming and proving on a NC lathe for:-
  - a. Outside Turning
  - b. Facing and Step Turning
  - c. Taper Turning
  - d. Drilling
  - e. Outside Threading
- 7 Part Programming and Proving on a NC Milling Machine:-
  - a. Point to Point Programming
  - b. Absolute Programming
  - c. Incremental Programming
- 8 Part Programming and Proving for Milling a Rectangular Slot.

## ME- 321 APPLIED NUMERICAL TECHNIQUES AND COMPUTING LAB.

L     T     P  
-     -     2

Sessional marks : 50  
Practical marks : -  
Total marks : -  
Duration of exam : 2 hrs

**The students will be required to carry out the following exercises, that are based on the theory course ME-311 Numerical Methods and Computing, with the help of MATLAB software / Pascal / C / C++ on personal computer.**

1. Solution of Non-linear equation in single variable using the method of successive bisection.
2. Solution of Non-Linear equation in single variable using the Newton Raphson, Secant, Bi – Section and Modified Euler's, method.
3. Solution of a system of simultaneous algebraic equations using the Gaussian elimination procedure.
4. Solution of a system of simultaneous algebraic equations using the Gauss-Seidel iterative method.
5. Solution of a system of simultaneous algebraic equations using the Gauss-Seidel iterative method employing the technique of successive relaxation.
6. Numerical solution of an ordinary differential equation using the Euler's method.
7. Numerical solution of an ordinary differential equation using the Runge - Kutta 4<sup>th</sup> order method.
8. Numerical solution of an ordinary differential equation using the Predictor – corrector method.
9. Numerical solution of a system of two ordinary differential equation using Numerical intergration.
10. Numerical solution of an elleptic boundary value problem using the method of Finite Differences.

## ME – 323 PRACTICAL TRAINING VIVA-VOCE

At the end of fourth semester each student would undergo six weeks Practical Training in an industry/ Professional organization / Research Laboratory with the prior approval of the Director-Principal/ Principal of the concerned college and submit a written typed report along with a certificate from the organization. The report will be a evaluated during V Semester by a Board of Examiners to be appointed by the Director-Principal/ Principal of the concerned college who will award one of the following grades:

Excellent	:	A
Good	:	B
Satisfactory	:	C
Not satisfactory	:	F

A student who has been awarded 'F' grade will be required to repeat the practical training.

**INDIRA GANDHI UNIVERSITY, MEERPUR REWARI**  
**SCHEME OF STUDIES & EXAMINATIONS**  
**B.Tech. 3<sup>rd</sup> YEAR MECHANICAL ENGINEERING, SEMESTER- VI**

Course	Course Title	Teaching schedule				Marks For class work	Marks for Examination		Total Marks	Duration of Exam
		L	T	P	Total		Theory	Practical		
ME-302	Automobile Engineering	3	1	-	4	50	100	-	150	3
ME-304	Mechanical Machine Design-II	3	2	-	5	50	100	-	150	4
ME-306	Heat Transfer	3	1	-	4	50	100	-	150	3
ME-308	Automatic Control	3	1	-	4	50	100	-	150	3
ME-310	Measurement & instrumentation	3	1	-	4	50	100	-	150	3
ME-312	Industrial Engineering	3	1	-	4	50	100	-	150	3
ME-314	Automobile Engineering Lab	-	-	2	2	25	-	25	50	3
ME-316	Heat Transfer Lab	-	-	2	2	25	-	25	25	3
ME-318	Measurement & instrumentation Lab	-	-	2	2	25	-	25	25	3
ME-320	General Proficiency	-	-	2	2	50	-	-	50	-
	Total	18	7	8	33	450	600	100	1050	

**NOTE:**

1. Students will be allowed to use non-programmable scientific calculator. However, sharing of Calculator will not be permitted in the examination.
2. Each student has to undergo practical training of 6 weeks during summer vacation and its evaluation shall be carried out in the VII semester

## ME-302 AUTOMOBILE ENGINEERING

L	T	P
3	1	-

Sessional	: 50 Marks
Theory	: 100 Marks
Total	: 150 Marks
Duration of Exam	: 3Hrs.

Note: Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

### Section A

Introduction to Automobiles : Classification, Components, Requirements of Automobile Body; Vehicle Frame, Separate Body & Frame, Unitised Body, Car Body Styles, Bus Body & Commercial Vehicle Body Types; Front Engine Rear Drive & Front Engine Front Drive Vehicles, Four Wheel Drive Vehicles, Safety considerations; Safety features of latest vehicle; Future trends in automobiles.

Clutches : Requirement of Clutches – Principle of Friction Clutch – Wet Type & Dry Types; Cone Clutch, Single Plate Clutch, Diaphragm Spring Clutch, Multi plate Clutch, Centrifugal Clutches, Electromagnetic Clutch, Over Running Clutch; Clutch Linkages.

### Section B

Power Transmission: Requirements of transmission system; General Arrangement of Power Transmission system; Object of the Gear Box; Different types of Gear Boxes; Sliding Mesh, Constant Mesh, Synchro- mesh Gear Boxes; Epi-cyclic Gear Box, Freewheel Unit. Overdrive unit-Principle of Overdrive, Advantage of Overdrive, Transaxle, Transfer cases.

Drive Lines, Universal Joint, Differential and Drive Axles: Effect of driving thrust and torque reactions; Hotchkiss Drive, Torque Tube Drive and radius Rods; Propeller Shaft, Universal Joints, Slip Joint; Constant Velocity Universal Joints; Front Wheel Drive; Principle, Function, Construction & Operation of Differential; Rear Axles, Types of load coming on Rear Axles, Full Floating, Three quarter Floating and Semi Floating Rear Axles.

### Section C

Suspension Systems : Need of Suspension System, Types of Suspension; factors influencing ride comfort, Suspension Spring; Constructional details and characteristics of leaf springs.

Steering System : Front Wheel geometry & Wheel alignment viz. Caster, Camber, King pin Inclination, Toe-in/Toe-out; Conditions for true rolling motions of Wheels during steering; Different types of Steering Gear Boxes; Steering linkages and layout; Power steering – Rack & Pinion Power Steering Gear, Electronics steering.

### Section D

Automotive Brakes, Tyres & Wheels : Classification of Brakes; Principle and constructional details of Drum Brakes, Disc Brakes; Brake actuating systems; Mechanical, Hydraulic, Pneumatic Brakes; Factors affecting Brake performance, Power & Power Assisted Brakes; Tyres of Wheels; Types of Tyre & their constructional details, Wheel Balancing, Tyre Rotation; Types of Tyre wear & their causes.

Emission Control System & Automotive Electrical : Sources of Atmospheric Pollution from the automobile, Emission Control Systems – Construction and Operation of Positive Crank Case Ventilation ( PVC) Systems, Evaporative Emission Control, Heated Air Intake System, Exhaust Gas Recirculation ( ECR ) Systems, Air Injection System and Catalytic Converters; Purpose construction & operation of lead acid Battery, Capacity Rating & Maintenance of Batteries; Purpose and Operation of Charging Systems, Purpose and Operations of the Starting System; Vehicle Lighting System.

### Text Books:

1. Automobile Engineering by Anil Chhikara, Satya Prakashan, New Delhi.
2. Automobile Engineering by Dr. Kirpal Singh, standard Publishers Distributors.

### Reference Books:

1. Automotive Mechanics – Crouse / Anglin, TMH.
2. Automotive Technology – H.M. Sethi, TMH, New Delhi.
3. Automotive Mechanics – S.Srinivasan, TMH, New Delhi.
4. Automotive Mechanics – Joseph Heitner, EWP.
5. Motor Automotive Technology by Anthony E. Schwaller – Delmer Publishers, Inc.
6. The Motor Vehicle – Newton steeds Garrett, Butter Worths.



## ME- 304 MECHANICAL MACHINE DESIGN –II

L     T     P  
3     2     -

Sessional         : 50 Marks  
Theory             : 100 Marks  
Total                : 150 Marks  
Duration of Exam : 4 hrs.

Note:

1. Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

2. The paper setter will be required to mention in the note of the question paper that the use of following Design Data book is permitted:

- (i) Design Data Handbook (In SI and Metric Units) for Mechanical Engineers by Mahadevan
- (ii) Design Data Book PSG College of Technology Coimbatore

### Section A

Design for Production ; Ergonomic and value engineering considerations in design, Role of processing in design, Design considerations for casting, forging and machining. Variable Loading : Different types of fluctuating/ variable stresses, Fatigue strength considering stress concentration factor, surface factor, size factor, reliability factor etc., Fatigue design for finite and infinite life against combined variable stresses using Goodman and Soderberg's Criterion, Fatigue design using Miner's equation, Problems.

### Section B

Shafts : Detailed design of shafts for static and dynamic loading, Rigidity and deflection consideration.

Springs : Types of Springs, Design for helical springs against tension and their uses, compression and fluctuating loads, Design of leaf springs, Surging phenomenon in springs, Design Problem.

### Section C

Bearings : design of pivot and collar bearing , Selection of ball and roller bearing based on static and dynamic load carrying capacity using load-life relationship, Selection of Bearings from manufacturer's catalogue, types of lubrication – Boundary, mixed and hydrodynamic lubrication, Design of journal bearings using Raimondi and Boyd's Charts, Lubricants and their properties, Selection of suitable lubricants, Design Problems.

### Section D

Gears : Classification, Selection of gears, Terminology of gears, Force analysis, Selection of material for gears, Beam & wear strength of gear tooth, Form or Lewis factor for gear tooth, Dynamic load on gear teeth -Barth equation and Buckingham equation and their comparison, Design of spur, helical, bevel & worm gear including the Consideration for maximum power transmitting capacity, Gear Lubrication, Design Problems.

### Text Books:

1. Mechanical Engg. Design- Joseph Edward Shigley-Mc Graw Hill Book Co.
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi.

### Reference Books :

1. Engineering design – George Dieter, McGraw Hill, New York.
2. Product Design and Manufacturing –: A.K.Chitale and R.C.Gupta, PHI, New Delhi.
3. Machine Design An Integrated Approach: Robert L.Norton,Second Edition –Addison Wisley Longman
4. Machine Design : S.G. Kulkarni , TMH , New Delhi.

## ME –306 HEAT TRANSFER

L T P  
3 1 -

Sessional : 50 Marks  
Theory : 100 Marks  
Total : 150 Marks  
Duration of Exam : 3 Hrs.

Note:

1. Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

**2. The paper setter will be required to mention in the note of question paper that the use of Steam tables, Charts, Graphical plots is permitted.**

### Section A

Basics and Laws : Definition of Heat Transfer, Reversible and irreversible processes, Modes of heat flow, Combined heat transfer system and law of energy conservation.

Steady State Heat Conduction : Introduction, I-D heat conduction through a plane wall, long hollow cylinder, hollow sphere, Conduction equation in Cartesian, polar and spherical co-ordinate systems, Numericals.

### Section B

Steady State Conduction with Heat Generation : Introduction, 1 – D heat conduction with heat sources, Extended surfaces ( fins), Fin effectiveness 2-D heat conduction , Numericals.

Transient Heat Conduction : Systems with negligible internal resistance, Transient heat conduction in plane walls, cylinders, spheres with convective boundary conditions, Chart solution, Relaxation Method, Numericals.

### Section C

Convection: Forced convection-Thermal and hydro-dynamic boundary layers, Equation of continuity, Momentum and energy equations, Some results for flow over a flat plate and flow through tube, Fluid friction and heat transfer ( Colburn analogy ), Free convection from a vertical flat plate, Empirical relations for free convection from vertical and horizontal planes & cylinders, Numericals.

Thermal Radiation: The Stephen-Boltzmann law, The black body radiation, Shape factors and their relationships, Heat exchange between non black bodies, Electrical network for radiative exchange in an enclosure of two or three gray bodies, Radiation shields, Numericals.

### Section D

Heat Exchangers: Classification, Performance variables, Analysis of a parallel/counter flow heat exchanger, Heat exchanger effectiveness, Numericals.

Heat Transfer with Change of Phase: Laminar film condensation on a vertical plate, Drop-wise condensation, Boiling regimes, Free convective, Nucleate and film boiling, Numericals.

### Text Books :

1. Heat Transfer – J.P. Holman, John Wiley & Sons, New York.
2. Fundamentals of Heat & Mass Transfer–Incropera, F.P. & Dewill, D.P –John Willey New York.
3. Heat Transfer-Principles & Applications-Binay K. Dutta, PHI, New Delhi
  
1. Conduction of Heat in Solids – Carslow, H.S. and J.C. Jaeger – Oxford Univ. Press.
2. Conduction Heat Transfer – Arpasi, V.S. – Addison – Wesley.
3. Compact Heat Exchangers – W.M. Keys & A.L. Landon, Mc. Graw Hill.
4. Thermal Radiation Heat Transfer – Siegel, R. and J.R. Howell, Mc. Graw Hill.
5. Heat Transmission – W.M., Mc.Adams , Mc Graw Hill.

## ME- 308 AUTOMATIC CONTROLS

L T P  
3 1 -

Sessional Marks : 50  
Theory Marks : 100  
Total Marks : 150  
Duration of Exam : 3 hrs.

Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

### Section A

Introduction And Applications: Types of control systems ; Typical Block Diagram : Performance Analysis; Applications – Machine Tool Control, Boiler Control, Engine Governing, Aerospace Control, Active Vibration Control; Representation of Processes & Control Elements – Mathematical Modeling. Block Diagram Representation, Representation of Systems or Processes, Comparison Elements; Representation of Feedback Control systems – Block Diagram & Transfer Function Representation, Representation of a Temperature, Control System, Signal Flow Graphs, Problems.

Types of Controllers : Introduction : Types of Control Action; Hydraulic Controllers; Electronic Controllers; Pneumatic Controllers; Problems.

### Section B

Transient And Steady State Response: Time Domain Representation; Laplace Transform Representation; System with Proportional Control; Proportional – cum – Derivative control; Proportional – cum – Integral Control; Error Constants; Problems.

Frequency Response Analysis: Introduction; Closed and Open Loop Transfer Function; Polar Plots; Rectangular Plots; Nichols Plots; Equivalent Unity Feed Back Systems; Problems.

### Section E

Stability Of Control Systems : Introduction; Characteristic Equation; Routh's Criterion; Nyquists Criterion, Gain & Phase Margins: Problems.

Root Locus Method : Introduction; Root loci of a Second Order System; General Case; Rules for Drawing Forms of Root loci; Relation between Root Locus Locations and Transient Response; Parametric Variation; Problems.

### Section D

Digital Control System : Introduction; Representation of Sampled Signal; Hold Device; Pulse Transfer Function; Block Diagrams; Transient Response; Routh's Stability Criterion; Root Locus Method; Nyquists Criterion; Problems.

State Space Analysis Of Control Systems: Introduction; Generalized State Equation; Techniques for Deriving System State – Space Equations; Transfer Function from State Equations; Solution of State Vector Differential Equations; Discrete Systems; Problems.

### Text Books :

1. Theory & Applications of Automatic Controls by B.C. Nakra, Published by New Age International Pvt. Ltd. Publishers, New Delhi.
2. Modern Control Engg. by Ugata, Prentice Hall of India, New Delhi.

### Reference Books :

1. Automatic Control Systems by Kuo' Published by Prentice Hall of India, New Delhi.
2. Control System Engineering, I. J. Nagrath and M. Gopal, New Age , New Delhi.

## ME – 310 MEASUREMENTS AND INSTRUMENTATION

L T P  
3 1 -

Sessional : 50 Marks  
Theory : 100 Marks  
Total marks : 150 Marks  
Duration of Exam: 3 Hrs.

Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

### Section A

Instruments and Their Representation : Introduction, Typical Applications of Instrument Systems, Functional Elements of a Measurement System, Classification of Instruments, Standards and Calibration.

Static and Dynamic characteristics of Instruments : Introduction, Accuracy, Precision, Resolution, Threshold, Sensitivity, Linearity, Hysteresis, Dead Band, Backlash, Drift, Formulation of Differential Equations for Dynamic Performance- Zero Order, First Order and Second order systems, Response of First and Second Order Systems to Step, Ramp, Impulse and Harmonic Functions.

### Section B

Transducer Elements : Introduction, Analog and Digital Transducers, Electromechanical; Potentiometric, Inductive Self Generating and Non-Self Generating Types, Electromagnetic, Electrodynamical, Eddy Current, Magnetostrictive, Variable Inductance, Linearly Variable Differential Transformer, Variable Capacitance, Piezo-Electric Transducer and Associated Circuits, Unbonded and Bonded Resistance Strain Gages. Strain Gage Bridge circuits, Single Double and Four Active Arm Bridge Arrangements, Temperature Compensation, Balancing and Calibration, Ionisation Transducers, Mechano Electronic Transducers, Opto-Electrical Transducers, Photo Conductive Transducers, Photo Volatic Transducers, Digital Transducers, Frequency Domain Transducer, Vibrating String Transducer, Binary codes, Digital Encoders.

### Section C

Motion, Force and Torque Measurement : Introduction, Relative motion Measuring Devices, Electromechanical, Optical, Photo Electric, Moireringe, Pneumatic, Absolute Motion Devices, Seismic Devices, Spring Mass & Force Balance Type, Calibration, Hydraulic Load Cell, Pneumatic Load Cell, Elastic Force Devices, Separation of Force Components, Electro Mechanical Methods, Strain Gage, Torque Transducer, Toque Meter.

Intermediate, Indicating and Recording Elements : Introduction Amplifiers, Mechanical, Hydraulic, Pneumatic, Optical, Electrical Amplifying elements, Compensators, Differentiating and Integrating Elements,

### Section D

Pressure and Flow Measurement : Pressure & Flow Measurement, Introduction : Moderate Pressure Measurement, Monometers, Elastic Transducer, Dynamic Effects of Connecting Tubing, High Pressure Transducer, Low Pressure Measurement, Calibration and Testing, Quantity Meters, Positive Displacement Meters, Flow Rate Meters, Variable Head Meters, Variable Area Meters, Rotameters, Pitot-Static Tube Meter, Drag Force Flow Meter, Turbine Flow Meter, Electronic Flow Meter, Electro Magnetic Flow meter. Hot-Wire Anemometer.

Temperature Measurement : Introduction, Measurement of Temperature, Non Electrical Methods – Solid Rod Thermometer, Bimetallic Thermometer, Liquid-in-Glass thermometer, Pressure Thermometer, Electrical Methods – Electrical Resistance Thermometers, Semiconductor Resistance Sensors (Thermistors), Thermo–Electric Sensors, Thermocouple Materials, Radiation Methods (Pyrometry), Total Radiation Pyrometer, Selective Radiation Pyrometer.

### Text Books :

1. Measurement systems Application and Design. Ernest O. Doebelin, Tata McGraw Hill Edition (Fourth Edition) 2002.
2. Measurement and Instrumentation in Engineering, Francis S. Tse and Ivan E. Morse, Marcel Dekker.

### Reference Books :

1. Principles of Measurement and Instrumentation – Alan S. Morris Prentice Hall of India.
2. Mechanical Measurements : T.G. Beckwith, W.L. Buck and R.D. Marangoni Addison Wesley.
3. Instrumentation, Measurement and Analysis – B.C. Nakra and K.K. Chaudhary, TMH.
4. Mechanical Measurements by D. S. Kumar, Kataria & Sons.

L T  
3 1 -

Sessional : 50 Marks  
Theory : 100 Marks  
Total : 150 Marks  
Duration of Examination: 3 Hrs

Examiner will set 9 questions in total, two questions from each section and one question covering all sections which will be Q.1. This Q.1 is compulsory and of short answers type. Each question carries equal marks (20 marks). Students have to attempt 5 questions in total at least one question from each section.

### Section A

Definition of Industrial Engineering: Objectives, Method study, Principle of motion economy, Techniques of method study - Various charts, THERBLIGS, Work measurement - various methods, time study PMTS, determining time, Work sampling, Numericals.

Productivity & Workforce Management :Productivity - Definition, Various methods of measurement, Factors effecting productivity, Strategies for improving productivity, Various methods of Job evaluation & merit rating, Various incentive payment schemes, Behavioural aspects, Financial incentives.

### Section B

Manufacturing Cost Analysis: Fixed & variable costs, Direct, indirect & overhead costs, & Job costing, Recovery of overheads, Standard costing, Cost control, Cost variance Analysis - Labour, material, overhead in volume, rate & efficiency, Break even Analysis, Marginal costing & contribution, Numericals.

Materials Management : Strategic importance of materials in manufacturing industries, Relevant costs, Inventory control models - Economic order quantity (EOQ), Economic batch quantity (EBQ) with & without shortage, Purchase discounts, Sensitivity analysis, Inventory control systems - P,Q,Ss Systems, Service level, Stock out risk, determination of order point & safety stock, Selective inventory control - ABC, FSN, SDE, VED and three dimensional, Numericals.

### Section C

Quality Management: Definition of quality, Various approaches, Concept of quality assurance systems, Costs of quality, Statistical quality Control (SQC), Variables & Attributes, X, R, P & C - charts, Acceptance sampling, OC - curve, Concept of AOQL, Sampling plan - Single, Double & sequential, Introduction to TQM & ISO - 9000.

Production Planning & Control (PPC) : Introduction to Forecasting - Simple & Weighted moving average methods, Objectives & variables of PPC, Aggregate planning - Basic Concept, its relations with other decision areas, Decision options - Basic & mixed strategies, Master production schedule (MPS), Scheduling Operations Various methods for line & intermittent production systems, Gantt chart, Sequencing - Johnson algorithm for n-Jobs-2 machines, n- Jobs-3 machines, 2 Jobs n-machines, n-Jobs m-machines Various means of measuring effectiveness of PPC, Introduction to JIT, Numericals.

### Section D

Management Information Systems (MIS) : What is MIS ? Importance of MIS, Organizational & information system structure, Role of MIS in decision making, Data flow diagram, Introduction to systems analysis & design, Organizing information systems.

Product Design and Development: Various Approaches, Product life cycle, Role 3S's – Standardization, Simplification, Specialization, Introduction to value engineering and analysis, Role of Ergonomics in Product Design.

**Text Books:** 1. Production & Operations Management - Chary, TMH, New Delhi.  
2. Management Information Systems - Sadagopan, PHI New Delhi.  
3. Modern Production Management – S.S. Buffa, Pub.- John Wiley.

**Ref.Books:**1. Operations Management - Schroeder, McGraw Hill ISE.  
2. Operation Management - Monks, McGraw Hill ISE.  
3. Production & Operations Management - Martinich, John Wiely SE.  
4. Industrial & Systems Engineering - Turner, MIZE, CHASE, Prentice Hall Pub.

L    T    P  
-    -    2

Sessional        : 25 Marks  
Practical        : 25 Marks  
Total             : 50Marks  
Duration of Exam : 3 hrs.

**List of Experiments :**

1. To study and prepare report on the constructional details, working principles and operation of the following Automotive Engine Systems & Sub Systems.
  - (a) Multi-cylinder : Diesel and Petrol Engines.
  - (b) Engine cooling & lubricating Systems.
  - (c) Engine starting Systems.
  - (d) Contact Point & Electronic Ignition Systems.
  
2. To study and prepare report on the constructional details, working principles and operation of the following Fuels supply systems:
  - (a) Carburetors
  - (b) Diesel Fuel Injection Systems
  - (c) Gasoline Fuel Injection Systems.
  
3. . To study and prepare report on the constructional details, working principles and operation of the following Automotive Clutches.
  - (a) Coil-Spring Clutch
  - (b) Diaphragm – Spring Clutch.
  - (c) Double Disk Clutch.
  
4. To study and prepare report on the constructional details, working principles and operation of the following Automotive Transmission systems.
  - (a) Synchromesh – Four speed Range.
  - (b) Transaxle with Dual Speed Range.
  - (c) Four Wheel Drive and Transfer Case.
  - (d) Steering Column and Floor – Shift levers.
  
5. To study and prepare report on the constructional details, working principles and operation of the following Automotive Drive Lines & Differentials.
  - (a) Rear Wheel Drive Line.
  - (b) Front Wheel Drive Line.
  - (c) Differentials, Drive Axles and Four Wheel Drive Line.
  
6. To study and prepare report on the constructional details, working principles and operation of the following Automotive Suspension Systems.
  - (a) Front Suspension System.
  - (b) Rear Suspension System.
  
7. To study and prepare report on the constructional details, working principles and operation of the following Automotive Steering Systems.
  - (a) Manual Steering Systems, e.g. Pitman –arm steering, Rack & Pinion steering.
  - (b) Power steering Systems, e.g. Rack and Pinion Power Steering System.
  - (c) Steering Wheels and Columns e.g. Tilt & Telescopic steering Wheels, Collapsible Steering Columns.
  
8. To study and prepare report on the constructional details, working principles and operation of the following Automotive Tyres & wheels.
  - (a) Various Types of Bias & Radial Tyres.
  - (b) Various Types of wheels.

9. To study and prepare report on the constructional details, working principles and operation of the Automotive Brake systems.
  - (a) Hydraulic & Pneumatic Brake systems.
  - (b) Drum Brake System.
  - (c) Disk Brake System.
  - (d) Antilock Brake System.
  - (e) System Packing & Other Brakes.
10. To study and prepare report on the constructional details, working principles and operation of Automotive Emission / Pollution control systems.
11. Modeling of any two automotive systems on 3D CAD using educational softwares (eg. 3D modeling package/Pro Engineering/I-Deas/ Solid edge etc.)
12. Crash worthiness of the designed frame using Hypermesh and LS-Dyna solver or other software.

**NOTE :**

1. At least ten experiments are to be performed in the Semester.
2. At least seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or as designed & set by the concerned institution as per the scope of the syllabus.

**ME- 316 HEAT TRANSFER LAB.**

L T P  
- - 3

Sessional : 50 Marks  
Practical : 50 Marks  
Total : 100 Marks  
Duration of Exam : 3Hrs.

List of Experiments :

1. To determine the thermal conductivity of a metallic rod.
2. To determine the thermal conductivity of an insulating power.
3. To determine the thermal conductivity of a solid by the guarded hot plate method.
4. To find the effectiveness of a pin fin in a rectangular duct natural convective condition and plot temperature distribution along its length.
5. To find the effectiveness of a pin fin in a rectangular duct under forced convective and plot temperature distribution along its length.
6. To determine the surface heat transfer coefficient for a heated vertical tube under natural convection and plot the variation of local heat transfer coefficient along the length of the tube. Also compare the results with those of the correlation.
7. To determine average heat transfer coefficient for a externally heated horizontal pipe under forced convection & plot Reynolds and Nusselt numbers along the length of pipe. Also compare the results with those of the correlations.
8. To measure the emmissivity of the gray body (plate) at different temperature and plot the variation of emmissivity with surface temperature.
9. To find overall heat transfer coefficient and effectiveness of a heat exchange under parallel and counter flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.
10. To verify the Stefan-Boltzmann constant for thermal radiation.
11. To demonstrate the super thermal conducting heat pipe and compare its working with that of the best conductor i.e. copper pipe. Also plot temperature variation along the length with time or three pipes.
12. To study the two phases heat transfer unit.
13. To determine the water side overall heat transfer coefficient on a crossflow heat exchanger.
14. Design of Heat exchanger using CAD and verification using thermal analysis package eg. I-Deas etc.

**Note:**

- 1. At least ten experiments are to be performed in the semester.**
- 2. At least seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.**



L T P  
-- 2

Sessional : 25 Marks  
Practical : 25 Marks  
Total : 50 Marks  
Duration of Exam : 3 Hrs.

**List of Experiments :**

1. To Study various Temperature Measuring Instruments and to Estimate their Response times.
  - (a) Mercury – in glass thermometer
  - (b) Thermocouple
  - (c) Electrical resistance thermometer
  - (d) Bio-metallic strip
2. To study the working of Bourdon Pressure Gauge and to check the calibration of the gauge in a dead-weight pressure gauge calibration set up.
3. To study a Linear Variable Differential Transformer (LVDT) and use it in a simple experimental set up to measure a small displacement.
4. To study the characteristics of a pneumatic displacement gauge.
5. To measure load (tensile/compressive) using load cell on a tutor.
6. To measure torque of a rotating shaft using torsion meter/strain gauge torque transducer.
7. To measure the speed of a motor shaft with the help of non-contact type pick-ups (magnetic or photoelectric).
8. To measure the stress & strain using strain gauges mounted on simply supported beam/cantilever beam.
9. To measure static/dynamic pressure of fluid in pipe/tube using pressure transducer/pressure cell.
10. To test experimental data for Normal Distribution using Chi Square test.
11. To learn the methodology of pictorial representation of experimental data and subsequent calculations for obtaining various measures of true value and the precision of measurement using Data acquisition system/ calculator.
12. Vibration measurement by Dual Trace Digital storage Oscilloscope.
13. To find out transmission losses by a given transmission line by applying capacitive /inductive load.
14. Process Simulator.

**Note:**

1. **At least ten experiments are to be performed in the Semester.**
2. **At least seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the Syllabus.**