(With effect from the academic. year 2008-2009)

Revised Syllabus for

Mechanical Engineering

Sem III & IV

Scheme for SECOND YEAR ENGINEERING (R- 2007)

Semester IV

Sr No.	Subject	Th Hours	Pr Hours	Theory Exam Hours	Theory Marks	TW Marks	Pr Marks	Or Marks	Total Marks
1	Applied Mathematics IV	4	-	3	100	-	-	-	100
2	Theory of Machines I	4	2	3	100	25	-	-	125
3	Thermal Engineering	4	2	3	100	25	-	25	150
4	Production Processes II	4	2	3	100	25	-	25	150
5	Material Technology	3	2	3	100	25	-	-	125
6	Industrial Electronics	4	2	3	100	25	-	-	125
7	Machine Shop Practice II	-	2	6(PE)	-	25	50	-	75
	TOTAL	23	12	-	600	150	50	50	850

CLASS: SE (Mechanical / Automobile)			Semester- IV
SUBJECT: **APPLIED MATHEMATICS - IV**			
Periods per week 1Period of 60 min.	Lecture	4	
	Practical	--	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	--
	Term Work	--	--
	TOTAL	--	**100**

Sr. No.	Details	Hrs.
Module 01	1. **Fourier Series** 1.1 Orthogonal and orthonormal functions, Expression for a function in a series of Orthogonal functions 1.2 sine and cosine functions and their Orthogonality properties 1.3 Fourier Series of periodic functions with period 2π and 2L , Dirichlets theorem (only statement) 1.4 Even and odd functions 1.5 Half range sine and cosine series 1.6 Parsevalls relations (only statement) 1.7 Complex form of Fourier series 1.8 Fourier integrals with even and odd functions.	14
Module 02	2. **Partial Differential Equations** Partial differential equation governing transverse vibrations of an elastic string, its formulation and solution using Fourier series. Heat equation, steady- state configuration for heat flow. Two & Three dimensional Laplace equation.	12
Module 03	**3. Random Variables:** 3.1 Discrete and continuous random variables, probability mass function and density function. Probability distribution for random variables. Expected value, Variance.	02
Module 04	**4. Probability distributions:**	08

	4.1 Binomial, Poisson and Normal Distributions.	
Module 05	**5. Sampling theory:** 5.1 Sampling distribution. Test of Hypothesis. Level of significance, critical region. One tailed and two tailed tests. Interval Estimation of population parameters. Large and small samples. 5.2 Test of significance for Large samples: Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two samples. 5.3 Student's t-distribution and its properties. Test of significance of small **samples:** Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two Samples, Chi-square distribution and its properties, Test of the Goodness of fit.	07
Module 06	**6. Fitting of curves:** 6.1 Least square method: Fitting the straight line and parabolic curve. Bivariate Frequency Distributions, Correlation. Co-variance, Karl Pearson Coefficient & Spearman's Rank Co-relation Coefficient (non-repeated & repeated ranks, without proof) Regression Coefficient & lines of regression.	05

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Question one will be compulsory and based on maximum part of syllabus.
3. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only five question need to be solved.
5. In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Reference Books:

1. A Text Book of Applied Mathematics : P. N. & J. N. Wartikar
2. Mathematical Statistics : J. N. Kapoor & H. C. Saxena
3. Higher Engineering Mathematics : Dr. B. S. Grewal
4. Probability, Statistics and Random Processes : T. Veerarajan
5. Advance Engineering Mathematics : E. Kreyszig

CLASS: SE (Mechanical / Automobile)			Semester- IV
SUBJECT: **INDUSTRIAL ELECTRONICS**			
Periods per week 1Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	----	----
	Oral Examination	----	----
	Term Work	----	25
	TOTAL		**125**

Sr. No.	Details	Hrs.
Module 01	**1 Thyristors and their Applications** 1.1 Introduction 1.2 Applications 1.3 Symbolic Representations 1.4 Specification 1.5 Principal of Operating of an SCR 1.6 Two-Transistor Analogy of SCR 1.7 DIAC 1.8 TRIAC 1.9 Basic Triggering circuits for Tyristers 1.9 Rectifier Circuits using SCR	10
Module 02	**Invertors, Choppers, Dual Converters and Cycloconverters** Commutation circuits Inverters: series and parallel Choppers Dual Converters	10
Module 03	**Solid State Control of D.C. Motors**	08

	3.1 Introduction 3.2 Advantage of Electronic Control of device 3.3 D.C. Motor Speed Control 3.4 Speed Control of D.C Shunt Motors using Thyristor Technology 3.5 Over-voltage Protection of D.C. Motors 3.6 Overload Protection of D.C. motors 3.7 Closed loop control **Solid State Control of D.C. Motors** (a)Introduction (b) An A.C. Motor Control (c) Speed Control of Motors (d) Speed Control of A.C Shunt Motors using Thyristor Technology	
Module 04	Operational Amplifier 741 & ICNE 555 5.1 Introduction, pin diagram, characteristics , specifications 5.2 Applications of IC 741 - Integrator, differentiator,adder, comparator, Instrumentation amplifier 5.3 Application of IC555- Astable, Monostable, Bi-stable multivibrators, Timing circuts.	08
Module 05	**Solid State Control of A.C. Motors** **Digital Electronics** Binary logic, positive ,negative, ,logic Boolean algebra basic theorem, DeMorgan's theorem, logic circuits, standard logic gates, universal logic gates, Ex-OR and Ex-NOR (Symbol, equation and truth table), implementation of Boolean equation using basic gate and universal gate, reduction of Boolean equation using two variable K-Map.	08

Module 06	**Introduction to Microprocessor 8085** Architecture, Instruction sets, simple program writing, Interfacing with memory and Input/Output devices, Applications.	04

List of Experiments:

1. Firing Characteristic of An SCR
2. Half-wave Gate-controlled Rectifier Using One SCR
3. Single Phase Half-controlled Full-wave Rectifier using Two SCRs and Two Diodes
4. Illumination Control using SCR
5. Firing Characteristic of a Triac
6. Application of a Triac for Illumination Control
7. Unijunction Transistor Characteristic
8. SCR Controlled Emergency Light
9. Speed Control of D.C. Shunt Motor using SCR
10. LDR Application in a Light Activated Turn-OFF Circuit
11. Study of a Three phase Rectifier using Power Diodes
12. Study of an Electronic Timer using IC NE-555

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Only five question need to be solved.
3. Question one will be compulsory and based on maximum part of syllabus.
4. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
5. In question paper weight age of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Term Work:

Term work shall consist of minimum **08** experiments, assignments and written test. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments & assignments): …… 10 Marks.
- Test (at least one): …… 10 Marks.
- Attendance (practical & theory): …….. 05 Marks.

TOTAL: ……. 25 Marks.

Text Books:

1. S.K Bhattacharya/S Chatterjee, Tata McGraw Hill Publishing Company Limited

2. Industrial Electronics, by James Humphries, Leslie Sheets, 4e-Delmar Publication
3. Industrial Electronics by Biswanth Paul PHI
4. Industrial Electronics for Technicians – by J.A. Sam Wilson Joseph Rissi, Prompt Publication
5. Modern digital electronics – by R. P. Jain Mcgraw Hill Publication

CLASS: SE (Mechanical / Automobile)			Semester- IV
SUBJECT: **MACHINE SHOP PRACTICE - II**			
Periods per week 1Period of 60 min.	Lecture	--	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	--	--
	Practical	6(PE)	50
	Oral Examination	--	--
	Term Work	--	25
	TOTAL		75

Practical Examination:

Practical examination will be held for one day (6 hours) only and shall consist of preparation jobs in precision turning, boring, screw cutting, Drilling, shaping, grinding etc.

Term Work:

One composite job consisting minimum four parts employing operations on lathe, precision turning, screw cutting, boring etc. and involving the use of shaping, milling and grinding operations.

The distribution of marks for term work shall be as follows:

- Laboratory work (experiments): …… (20) Marks.
- Attendance (practical): …….. (05) Marks.

TOTAL: …… (25) Marks.

CLASS: SE (Mechanical / Automobile)			Semester- IV
SUBJECT: **MATERIAL TECHNOLOGY**			
Periods per week 1Period of 60 min.	Lecture	3	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	--
	Term Work	--	25
	TOTAL		125

Sr. No.	Details	Hrs.
Module 01	**Lattice Imperfections.** Definition, classification and significance of Imperfections Point defects, vacancy, interstitial and impurity atom defects. Their formation and effects. Dislocation: Edge and screw dislocations Burger's vector. Motion of dislocations and their significance. Surface defects, Grain boundary, sub- angle grain boundary and stacking faults. Their significance. Generation of dislocation. Frank Reed source, conditions of multiplication and significance. Dislocation interactions, Elimination, multicomponent dislocation, Dislocation pile up. Dislocation jog dislocation climb. **Deformation:** Definition, elastic and plastic deformation and significance in design and shaping Deformation in single crystal and polycrystalline materials Mechanism of deformation. Critical stress for deformation. Deformability of FCC, BCC. and HCP lattice , slip systems. **Strain Hardening:** Definition importance of strain hardening. Dislocation theory of strain hardening, Effect of strain hardening on engineering behaviour of materials. Recrystallization Annealing. Theory and stages of recovery. Recrystallization and grain growth. Factors affecting recrystallation.	8

	Recrystallation temperature. Hot and cold working theory. Their advantages, limitations and applications.	
Module 02	**<u>Fracture</u>** Definition and types of facture. Brittle fracture. Griffth's teory of facture. Orowan's modification. Dislocation theory of facture. Critical stress and crack propagation velocity for brital fracture. Ductile fracture. Notch effect on fracture. Fracture toughness. Ductility transition. Definition and signification. Conditions of ductility transition factors affecting it. **<u>Fatigue Failure:</u>** Definition of fatigue and significance of cyclic stress. Mechanism of fatigue and theories of fatigue failure Fatigue testing. Test data presentation and statistical evolution. S.N. Curve and its interpretation. Influence of important factors on fatigue. Notch effect surface effect. Effect of pre-stressing, corrosion fatigue Thermal fatigue. **<u>Creep</u>** Effect of temperature on mechanical behaviors of materials. Definition and signification of creep. Creep testing and data presentation. Mechanism and types of creep. Analysis of classical creep curve. Creep Resistant materials.	8
Module 03	**<u>Theory of Alloys& Alloys Diagrams</u>** Significance of alloying, Definition. Classification and properties of different types of alloys. Different types of alloy diagrams and their analysis. Importance of Iron as engineering material, Allotropic forms of Iron, Influence of	6

	carbon in Iron-Carbon alloying. Iron- Iron carbine diagram and its analysis.	
Module 04	**<u>Heat treatment Process</u>**: Technology of heat treatment. Classification heat treatment process. Annealing- Principle process, properties and applications of full annealing, Diffusion annealing, process annealing and Cyclic annealing, Annealing defects and their remedies. Normalizing. Hardening heat treatment, Hardening baths, Hardening media, Salt baths, Hardenabilitiy. Tempering, Subzero treatment, Austempering, Martempering, Maraging and Ausforming process.	6
Module 05	**<u>Surface Hardening & Diffusion Coating Processes</u>** Hardening and surface Hardening methods. Their significance and applications. Carburizing, Nitriding, Cyaniding, Carbonnitriding, induction hardening and flame hardening processes. Diffusion coating processes of Colorizing, Chromising, Siliconizing and Boron diffusion.	4
Module 06	**<u>Effect of Alloying Elements in Steels:</u>** Limitation of plain carbon steels. Significance of alloying elements. Effects of major and minor constituents, Effect of alloying elements on ferrite, carbide, austenite, Effect of alloying elements on phase transformation, decomposition, hardening and tempering. Classification of tool steels and metallurgy of tool steels and special steels. **<u>Strengthening Mechanism:</u>** Theory and applications of strain hardening, Age hardening, Precipitation hardening and Dispersion hardening,	4

<u>Theory Examination:</u>

1. Question paper will comprise of total seven question, each of 20 Marks
2. Only five question need to be solved.
3. Question one will be compulsory and based on maximum part of syllabus.
4. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
5. In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Term Work:

Term work shall consist of

1. Assignments: On topics drawn from syllabus.
2. Practicals: Base on topics from syllabus experiments can be conducted and presented with inferences.
3. Factory report: Preparation of equipment, process, quality control and failure analysis of engineering components reports after visit to important industrial plants.
4. At least one class test.

The distribution of marks for term work shall be as follows:

- Laboratory work (assignments, Practicals, Factory report): …… 10 Marks.
- Test (at least one): …… 10 Marks.
- Attendance (practical & theory): …….. 05 Marks.

TOTAL: ……. 25 Marks.

Text Books:

1. Mechanical Metallurgy: G.E. Dieter , McGraw hill International New Delhi.
2. The Structure and Properties of Materials Vol I: M. G. Moffet, G. T. W. Pearsall & J. Wulff.
3. Materials Science and Engineering by William D. Callister, Jr. – Adapted by R. Balasubramaniam. Wiley India (P) Ltd.
4. Metallurgy for Engineer- E.C. Rollason - ELBS SOC. And Edward Arnold, London.
5. Mechanical Behaviour of Materials- Courtney- McGraw hill International New Delhi.

References:

1. Metallurgy Engineering Part I&II-R. A. Higginns & Hodder Stoughlon, London.
2. A text book of Metallurgy- A.R.Bailey – Macmillan & Co. Ltd., London.
3. Introduction to solids- L.V.Azarooff- McGraw hill International New Delhi.
4. The Structure and Properties of Engineering Alloys- W.F. Smith- McGraw hill International, New Delhi.
5. Strengthening of Metals Packner - Reinhild Puplishing Corporation, New Delhi.
6. Engineering Physical Metallurgy, By Y. Lakhtin , Mir Publishers, Moscow.
7. Physical Metallurgy for Engineers, By Donald S. Clarke and Wibur R. Varney, D. Van Nostrand Co.INC.
8. Engineering Metallurgy Part I & II, By Raymond A. Higgins, English Language Book Society &Hodder & Stragton.
9. A text book of Metallurgy, By A.R.Bailey Mc Millan & ltd ,London.
10. Structure and Properties of Alloys, By Robert M, Brick, Robert B, Gordon , McGraw hill International Book Co.
11. Metallurgy for Engineers, By E.C. Rollason, English Language Book Society &Edward Arnold Publisher Ltd.
12. Introduction of Engineering Materials, By B.K. Agrawal, McGraw hill Publishing Co. ltd.

13. A text book of Egg,. Metallurgy and material technology ,by N V Fursule satya pub,New Delhi.
14. The Science and Engineering of Materials, By Donald R. Askeland- PWS Publishing Co.
15. Physical Metallurgy by Avener

CLASS: SE (Mechanical / Automobile)			Semester- IV
SUBJECT: **PRODUCTION PROCESS -II**			
Periods per week 1Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**Design of Jig and Fixtures:-** Need for jigs fixtures, elements of Jigs and fixtures, principles of location, design of locating elements, locating pins support pins spring back, vee blocks, etc. principles of clamping simple hand operated clamps, like screw clamp, lever clamps and other types of clamps. Drill bushes- their types and applications indexing devices, auxiliary elements. Design of drill jigs like plate leaf solid and box types for drilling combined with reaming, spot facing etc. design of milling fixtures such as plain, string , gang and indexing types. Design of turning fixtures.	09
Module 02	**Metal Cutting & Tool Engineering:** features of machining processes, concept of speed and cutting, mechanism of chip formation, concept of shear plane, chip reduction coefficient force analysis. Merchants circle of cutting forces, expression for shear plane angle and coefficient of friction in tern of cutting forces and tool angles. Merchants theory- original and modified cutting force and power calculation in machining processes, gross power , efficiency of machine tools, effect of various parameters on cutting forces, methods of estimating of cutting forces. **Economics of metal cutting:-** parameters affecting machining cost. Tool life for minimum cost and for max. Productivity.	8
Module 03	Measurement of cutting forces**:-** different types of dynamometers and their operations. Tool life definition, mechanism of tool wear and measurement, preliminary and ultimate feature, factors Influencing tool life such as speed, feed, depth of cut, tool material, cutting fluids etc. Surface finish-influence of various parameters cutting tool materials-composition, field of application and manufacture.(carbon tool steel, high speed steel, non-ferrous alloys, carbides and ceramics) coolants –function of coolants, effects on cutting force, tool life and surface finish, Types of coolants, Choice of coolants.	8
Module 04	**Design of cutting Tools:-** Tool geometry and definition of principles tool angles of single point cutting tools, Design of single point cutting tools, Form tools, Boring tools, Drills, Reamers Milling cutters, Inserted type cutters, Broach tools, Milling:-mechanism of process, mean chip thickness, power calculation in milling. . gear milling, standard cutters and limitations, gear hobbing, gear shaping, gear shaving and gear grinding processes.	07
Module	**Sheet-metal Working:-** Elementary treatment of press working, operation on presses ,press devices and classification of presses, design of blanking,	10

o5	piercing, compound, progressive, bending, forming, and drawing dies, load calculations, development of blanks , scrap strip layout, design of punches, selection of die-sets, stock guides, strippers, pilots, stop, etc. selection of presses, capacities and other details.	
Module o6	**Rolling and Forming of metal:** Principles and process characteristics, Rolling mill-types and capacities, Rolling parameters: Draught, spread, elongation ,roll pressure, torque, work and power in rolling., Effect of front and back tension on rolling load, Principles of roll pass design.. Miscellaneous processes like thread rolling, Rolling defects. .Forging ,extrusion ,rotary swaging (process, types, advantages ,limitations and applications only)	06

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks

2. Only five question need to be solved.

3. Question one will be compulsory and based on maximum part of syllabus.

4. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then

part (b) will be from any module other than module 3)

5. In question paper weightage of each module will be proportional to number of respective lecture hours as

mentioned in the syllabus.

Oral Examination :

Oral examination will be on maximum portion of syllabus.

Term Work:

At least one assignment on each module of the Syllabus shown above including at least two A-3 Sheets on press tools and Jigs and fixtures.

The distribution of marks for term work shall be as follows:

- Assignments : ……. (10) Marks.
- Test (at least one): …… (10) Marks.
- Attendance (practical & theory): …….. (05) Marks.

TOTAL: ……. (25) Marks.

Text Books:

1. Tool Design By Donaldson.
2. Jigs & Fixtures By P H Joshi.
3. Prod.Tech. By R.C.Patel & C.G. Gupte.
4. Workshop Tech. By W.Aj. Chapman
5. Machining Process By H.L. Juneja

References:

1. Fundamentals of Tool Design By ASTME
2. Metal cutting Theory & Cutting Tool Designing By V. Arshinov, G Alekseev
3. Fundamentals of By Donaldson
4. principle of Metal cutting By Sen & Bhattacharya
5. Fundamentals of Metal MACHINING By Geoffery Boothroyd
6. Fundamentals of Tool Design By ASTME
7. Introduction to Jigs & Tool Design By MHA Kempster.
8. Production Tooling & Equipment By WA J Parsons
9. Die Design Fundamentals By J.R. Paquin.
10. Rolling of Strip, Sheet & Plate By E C Larke & M.Cook.
11. RollPass Design By British Steel Corporation
12. Techniques of Press Working Sheet Metal By Earry Reed
13. Production Technology - HMT

CLASS: SE (Mechanical / Automobile)			Semester-IV
SUBJECT: **THERMAL ENGINEERING**			
Periods per week 1Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**Combustion of refractive mixtures:** Combustion reactions, stoichiometric air A/F, actual A/F ratio, Heat of combustion-open and closed system, Enthalpy and internal energy of reaction. Enthalpy of formation. Calorific value at constant pressure and constant volume. First law for reactive system, Adiabatic combustion temperature. Entropy changes for reacting mixtures.	8
Module 02	**Compressors - Reciprocating**: Single stage reciprocating compressor-neglecting clearance. Multistaging of compressors. Two stage air compressors, Perfect inter-cooling. Ideal inter cooler pressure. Minimum work, Free air delivered, volumetric efficiency, isothermal and adiabatic efficiency. Effect of clearance volume on F.A.D and volumetric efficiency, Work, power and efficiency calculations.	8
Module 03	**Steam Generator**: Fire tube and water tube boiler, Low pressure and High-pressure boilers, once through boiler, examples, Important features of HP boilers, Mountings and accessories. Layout of a modern HP boiler. Equivalent evaporation of boilers. Boiler performance. Boiler efficiency.	8
Module 04	**Steam Condensers:** Elements of condensing plant, Types of condensers, surface and evaporative condenser. Partial pressure, effect of air leakage, vacuum efficiency, Air pump capacity, Mass of cooling water.	6
Module 05	**Steam Nozzles**: Flow through steam nozzle- velocity at exit and condition for maximum discharge, nozzle efficiency. **Steam Turbines:** Basic of steam turbine, Classification, compounding of turbine, Impulse turbine-velocity diagram, condition for maximum efficiency. Reaction turbine- velocity diagram, degree of reaction, Parson's turbine. Condition for maximum efficiency.	10
Module 06	**Gas Turbine**: Application of gas turbine, Actual Brayton cycle, open and closed cycle gas turbine, methods to improve efficiency and specific output, open cycle with intercooling, reheat, and regeneration. Effect of operating variable on thermal efficiency and work ratio.	8

List of Experiments:

1. Study of boilers mountings and accessories
2. Study of experiments on heat balance sheet of boiler.
3. Study of experiments on gas turbine
4. Study of experiments on mass flow rate of air through orifice plate or nozzle.
5. Study of steam turbines.
6. Trial on air compressors.
7. Study of experiments on calorific value at constant pressure and constant volume.
8. Determination of dryness fraction

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Only five question need to be solved.
3. Question one will be compulsory and based on maximum part of syllabus.
4. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
5. In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Term Work:

Term work shall consist of minimum **07**experiments, assignments, written test and a Report on visit of Thermal Power Plant. The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments/ Visit Report): 10Marks.
- Test (at least one): …… 10Marks.
- Attendance (practical & theory): …….. 05Marks.

TOTAL: ……. 25Marks.

Oral Examination:

Oral examination will be based on the list of experiments given in the syllabus and the term work.

Text Books:

1. Thermal Engineering by Ballaney, Khanna Publishers, Reprint 1994.
2. Thermal Engineering by Kothandraman, Domkundwar, Khajuria, Arrora Dhanpatrai & sons.
3. Thermal Engineering by R. K. Rajput.
4. Steam and gas Turbine by R. K. Yadav.

5. Thermodynamics by P. K. Nag – Tata Mcgraw Hill co. Reprint 1992.
6. Thermodynamics and Heat Engines Vol II by R. Yadav, Central Publishing house, Reprint 1994.
7. Turbines, Compressors and Fans by S. M. Yahya, Tata Mcgraw Hill.

References:

1. Principle of Thermodynamics by H. A. Sorensen, A. Merimal Publications, 1972
2. Applied Thermodynamics for Engineers and Technologists By Eastop and Mcconky Longman 1978.

CLASS: SE (Mechanical / Automobile)			Semester- IV
SUBJECT: **THEORY OF MACHINES - I**			
Periods per week 1Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	--
	Term Work	---	25
	TOTAL		**125**

Sr. No.	Details	Hrs.
Module 01	**1. Basic Kinematics:** **1.1 Structure, Machine, Link and its types** **1.2 Kinematics pairs** Lower pairs and higher pairs ,Form closed pairs and force closed pairs, Based on relative motion permitted such as revolute, prismatic, cam, helical, Globular. **1.3 Kinematics chain and Mechanisms:** Grubler's criterion for movability of chains and mechanisms has locked, constraint, Unconstrained based on Grubler's criteria. Limitations of Grubler's Criteria. **1.4 Inversion of chain:** Study of various mechanisms derived from inversions of following chains with regard to motion of links of mechanisms, motion modification, quality of motion transmission (uniform, non-uniform, SHM, Non-SHM), limiting positions, dead positions, quick return property, applications. Four bar chain (Grashoffian, non-Grashoffian), Single slider crank chain, Double slider crank chain. **1.5 Special Mechanisms:** Straight line generating Mechanisms**:** Exact Straight Line Generating Mechanisms – Peaucellier's, Hart's . Approximate Straight Line Generating Mechanisms – Watt's, Robert's, Evan's and tchebicheff's. Offset slider crank mechanisms, Pantograph, Hook joint- single and double, Steering gear mechanisms – Ackerman, Davis	10
Module 02	**Velocity and Acceleration analysis of mechanism (mechanisms up to 6 links).** 2.1 Velocity analysis by instantaneous centre of rotation method (Graphical approach)	10

	2.2 Velocity analysis by relative velocity method (Graphical approach) Analysis is extended to find rubbing velocities at joints, mechanical advantage (Graphical approach). 2.3 Velocity and Acceleration – analysis by relative method (mechanisms upto 6 link) including pairs involving Coriolis acceleration (Graphical Approach).	
Module 03	**Kinetics of Rigid Bodies:** 3.1 Mass M. I. about centroidal axis and about any other axis. Radius of Gyration, DAlemberts Principle of bodies under rotational motion about a fixed axis and plane motion. Applications of motion of bars, cylinders and spheres only. 3.2 Kinetics of Rigid Bodies : Work and Energy Kinetic energy in translating motion, Rotation about fixed axis and in general plane motion. Work energy principle and conservation of energy.	7
Module 04	**Static & Dynamic force analysis of plane mechanisms**: 4.1 Static and dynamic force analysis in slider crank mechanisms (neglecting mass of connecting rod and crank), Engine force analysis, Turning moment on crank shaft 4.2 Dynamically equivalent systems to convert rigid body to two mass systems with and without correction couple. 4.3 Flywheel and its applications, Fluctuation in energy, function of flywheel, estimating inertia of flywheel for reciprocating prime movers and machines.	7
Module 05	**Flexible Connectors:** **5**.1 Belt & Rope Drives – Types of belts, velocity ratio, slip & creep of belt, length of belt for open & cross systems, law of belting, dynamic analysis-driving tensions, centrifugal tension, initial tension, condition of maximum power transmission. 5.2 Chains – types of chains, chordal action, variation in velocity ratio, chain length.	6
Module 06	**Gears** 6.1 Law of gearing, Conjugate profile and its graphic construction, Involute and Cycloid gear tooth profile, Construction of Involute profile. 6.2 Path of contact, arc of contact, contact ratio for involutes and cycloid tooth profile, Interference in involutes gears. Critical Numbers of teeth for interference free motion, Methods to control interference in involutes	8

	gears. 6.3 Static force analysis in gears- spur, bevel, helical, worm & worm gears	

Theory Examination:

1. Question paper will comprise of total seven questions, each of 20 Marks

2. Only five question need to be solved.

3. Question one will be compulsory and based on maximum part of syllabus.

4. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)

5. In question paper weight age of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Term Work:

Assignment based on topics covered under all modules 1 to 6. **(To be covered in practical Hrs.)** minimum 4 problems on each module.

Graphic work (on half imperial drawing sheets)

Text Books:

1. Theory of Mechanisms and Machines by Amitabha Ghosh and A. Kumar Mallik.
2. Theory of Mechanisms and Machines by Shigley
3. Theory of Machines by Ballaney
4. Theory of Machines by Rattan.

References:

1. Kinematics of Machines by R. T. Hinchkle (Prentice Hall Inc.)
2. Kinematics by V. M. Fairs (Mcgraw Hill)
3. Mechanism Design: Analysis and Synthesis Vol. I by A. Erdman and G. N. Sander (Prentice Hall Inc.)
4. Kinematics and dynamics of Planer Mechanisms by Jeremy Hirisishai (Mcgraw Hill).

The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments): …….. 10 Marks.
- Test (at least one): …… 10 Marks.
- Attendance (practical & theory): …….. 05 Marks.