SCHEME OF INSTRUCTIONS AND EXAMINATION (R-2007)

UNIVERSITY OF MUMBAI

COURSE: B.E. (MECHANICAL ENGINEERING)

YEAR: S.E., SEMESTER: III

Sr. No	Subjects	No. of periods of 1Hour			Duration of Theory Paper in Hours	Marks				
		Lecture	Practical	Tutorial		Theory Paper	Term Work	Practical	Oral	Total
1	Applied Mathematics-III	4	--	1	3	100	25	--	--	125
2	Strength of Materials	4	2	--	3+2(PE)	100	25	25	25	175
3	Machine Drawing	3	5	--	4+3(PE)	100	25	50	--	175
4	Production Process - I	4	--	--	3	100	25	--	--	125
5	Thermodynamics	4	--	1	3	100	25	--	25	150
6	Presentation and Communication Techniques $	2	2	--	--	--	50	--	--	50
7	Machine-shop Practice - I	--	3	--	--	--	50	--	--	50
TOTAL		21	12	2	--	500	225	75	50	850

All Subjects are Common with Automobile engineering.

$ Common with all branches.

(PE) - Practical Examination

COURSE: B.E. (MECHANICAL ENGINEERING)

YEAR: S.E., SEMESTER: IV

Sr No	Subjects	No. of periods of 1Hour			Duration of Theory Paper in Hours	Marks				
		Lecture	Practical	Tutorial		Theory Paper	Term Work	Practical	Oral	Total
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 Process - 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

All Subjects are Common with Automobile engineering.

(PE) - Practical Examination

CLASS: SE (Mechanical / Automobile) Semester-III

SUBJECT: **APPLIED MATHEMATICS III**

Periods per week 1Period of 60 min	Lecture	4		
	Practical	--		
	Tutorial	1		
		Hours	Marks	
Evaluation System	Theory Examination	3	100	
	Practical	--	--	
	Oral Examination	--	--	
	Term Work	--	25	
	TOTAL		125	

Sr. No.	Details	Hrs.
Module 01	**1. Complex Variables**	08
	1.1 Functions of Complex variable	
	1.2 Continuity (only statement) and derivability	
	1.3 Analytic Function, Necessary conditions for the function to be analytic	
	(statement of sufficient condition)	
	1.4 Cauchy Riemann equations in polar coordinates	
	1.5 Harmonic function and orthogonal trajectories	
	1.6 Milne-Thomson method to find analytic Function f(z)=u+iv for given u, v, u+v, u-v	
Module 02	**2. Mapping**	03
	2.1 Conformal mapping	
	2.2 Standard transformations and Bilinear transformation	
	2.3 Fixed points and cross ratio	
Module 03	**3. Complex Integration**	11
	3.1 Regions and Paths in the Z-plane	
	3.2 Line integral of a function of complex variable	
	3.3 Cauchy's integral theorem	
	3.4 Cauchy's integral formula and deduction (without proof)	
	3.5 Taylor's and Laurent's development (without proof)	
	3.6 Singularities, poles, residue at isolated singularity and its evaluation	
	3.7 Residue Theorem	
Module 04	**Laplace's Transforms**	07
	4.1 Function of bounded variation (statement only)	
	4.2 Laplace's transforms of 1, t^n, e^{at}, sin(at), cos (at), sinh (at), cosh (at)	
	4.3 Linearity property, expressions (without proof) for $L[e^{at} f(t)]$,	
	$L[f(at)]$, $L[t^n f(t)]$, $L[f(t)/t]$,	
	4.4 Periodic functions, Heaviside unit step function, Dirac- delta Function and their Laplace transforms (statement only)	
Module	**5. Inverse Laplace Transforms**	07

05	5.1 Linearity property evaluation of inverse Laplace Transforms using theorems and by partial fraction method 5.2 Convolution Theorem (without proof) and Heaviside development 5.3 Application to solve initial and boundary valve problems involving ordinary differential equations with one dependent variable	
Module 06	6. Matrices 6.1 Types of Matrices. 6.2 Adjoint of a matrix, Inverse of a matrix, Orthogonal and Unitary Matrices. 6.3 Elementary transformations, rank of a matrix. 6.4 Reduction to a normal form. 6.5 System of homogeneous and non homogeneous equations, their Consistency and solution. 6.6 Brief revision of vectors over real field , Inner product, Norm, Linear dependence and independence, Orthogonality of matrix 6.7 Characteristic polynomial, values and vectors of square matrix 6.8 Characteristic polynomial, Cayley Hamilton Theorem (without proof) Functions of square matrix.	12

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.

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

Term Work:

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

- Tutorial work (One assignment on each module containing 05 problems): 10 Marks.
- Test (at least one): ..... 10 Marks.
- Attendance (Tutorial & theory): ..... 05 Marks.

TOTAL: ..... 25 Marks.

References:

1. Matrices : Vasistha
2. A Text Book of Applied Mathematics : P. N. & J. N. Wartikar
3. Higher Engineering Mathematics : B. S. Grewal
4. Advance Engineering Mathematics : E. Kreyszig
5. Complex variables : R. V. Churchil
6. Laplace Tranforms : Schaum series

CLASS: SE (Mechanical / Automobile) Semester- III

SUBJECT: **STRENGTH OF MATERIALS**

Periods per week 1Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	2	25
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		**175**

Sr. No.	Details	Hrs.
Module 01	**STRESS AND STRAIN:-** Definition, Stress strain, tensile and compressive , stresses, shear stress-Elastic limit, Hooke's law, Poisson's ratio, modulus of elasticity, modulus of rigidity, bulk modulus, yield stress, ultimate stress, factor of safety, state of simple shear, relation between elastic constants, volumetric strain, volumetric strain for tri-axial loading, deformation of tapering members, deformation due to self weight, bars of varying sections, composite sections, Temperature stresses.	08
Module 02	**SHEAR FORCE AND BENDING MOMENT IN BEAMS:** Axial force, shear force and bending moment diagrams for statically determinate beams including beams with internal hinges for different types of loading, relationship between rate of loading, shear force and bending moment.	08
Module 03	**STREESES IN BEAMS:-** Theory of pure banding, Assumptions, Flexural formula for straight beams, moment of resistance, bending stress disiribution , Section moduli for different sections, beams of uniform strength , Flitched beams, Principle axes, Principle moment of inertia. **Direct and bending stresses**, Core of section, Chimneys subjected to wind pressure. **SHEAR STRESSES IN BEAMS :** Distribution of shear stress across plane sections used commonly for structural purposes, shear connectors	08
Module 04	**TORSION**: Torsion of circular shafts – solid and hollow, stresses in shaft when transmitting power, Shafts in series and parallel. **STRAIN ENERGY** , Resilience, proof Resilience, Strain energy stored in the member due to gradually applied load, suddenly applied load, impact load, strain energy stored due to shear. Strain energy due to bending, Strain energy due to Torsion.	08
Module 05	**DEFLECTION OF BEAMS**: Deflection of cantilevers, simply supported and over hanging beams using double integration and Macaulay's methods for different types of loadings **THIN CYLINDRICAL AND SPHERICAL SHELLS:** Stress and strain in thin Cylinders and spheres due to internal pressure, Cylindrical shell with hemispherical ends.	08
Module 06	**PRINCIPLE STRESSES:** General equations for transformation of stress, principal planes and principal stresses, maximum shear stress, determination using Mohr's circle, maximum principal & max. Shear stress theory of failure, Combined Bending and Torsion, Equivalent Bending moment and equivalent torque. **COLUMNS AND STRUTS:** Buckling load, Types of end conditions for column, Euler's column theory and its Limitations, Ranakin Gordon Formula.	08

List of Experiments:

1. Tension test on mild steel bar (stress- strain behavior, modulus determination)
2. Test on tor-steel
3. Test on cast iron (transverse, tension)

5. Torsion test on mild steel bar/cast iron bar
6. Brinell hardness test
7. Rockwell hardness test
8. Izod impact test/Charpy test
9. Flexural test on beam (central point load)
10. Flexural test on beam (two point load) (Plotting of load deflection curve & finding value of E for experiment no. 9&10)

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

Practical and Oral Examination:

Practical and oral examination will be based on one experiment performed from the list of experiment given in the syllabus and the oral will based on the same experiment.

Term Work:

Term work shall consist of minimum 07 experiments, assignments min" 24 problems (4 problems on each module) 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. Mechanics of Structures Vol.-1 — SB Junnakar & shah, Charotar Publishers
2. Strength of Materials — S. Ramamarutham
3. Engineering Mechanics — Timoshenko & Young, Tata McGraw Hill
4. Mechanics of Materials — EP Popov, Prentice Hall of India
5. Strength of Materials — W.A. Nash Schaum's outline series, Tata McGraw Hill

References:

1. Mechanics of Materials — James Gere-Thompson Learning
2. Mechanics of Materials — Ferdinand P Beer, E Russell Johnson, Jr.John Dewolf, McGraw Hill International
3. Theory of Elastic Stability — Timoshenko & Gere, Tata Mcgraw Hill
4. Strength of Materials — G.H. Ryder MACMILLAN
5. Strength of Materials — R. Subramaniam OXFORD
6. Strength of Materials A Practical Approach (Volume-I) D. S. Prakash Rao Univrsity Press
7. Mechanics of Materials — Riley Wiley India

CLASS SE (Mechanical / Automobile) Semester- III

SUBJECT: MACHINE DRAWING

Periods per week 1Period of 60 min	Lecture	3	
	Practical	5	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	4	100
	Practical	3	50
	Oral Examination	--	--
	Term Work		25
	TOTAL		175

Sr. No.	Details	Hrs.
Module 01	**Solid Geometry:** Intersection of surfaces and Interpretation of solids- Intersection of prism or cylinder with Prism cylinder or cone both solids in simple position only, Primary auxiliary views and aux. projections of simple machine parts.	09
	Machine Elements : Free hand sketches of M/C elements such as bolts, nuts, washers, studs, tapped holes, Conventional representation of assembly of Threaded parts in external and sectional Conventional representation of assembly of Threaded parts in external and sectional Views.	
Module 02	**Details and Assembly Drawing:** introduction to unit assembly drawing steps involved in preparing assembly drawing from details and vice versa.	07
	Preparation of details & assembly drawings of Clapper block, Single tool post, Lathe & Milling tail stock, Cotter, knuckle joint, Keys and coupling: Keys-sunk, parallel, woodruff, saddle, feather etc.	
	Coupling - simple, muff, Flanged, protected flange coupling, Oldham's coupling, universal Coupling.	
Module 03	**Preparation of Details & Assembly Drawings of Bearings-** simple, solid, bushes, pedestal, footstep, I.S. conventional representation of ball and bearings.	03
Module 04	**Preparation of Details & Assembly Drawings of** Pulleys-flat belt, V-belt, rope belts fast and loose pulleys, Pipe joints: flanged joints- spigot and gland and stuffing box, expansion joint	06
Module 05	**Preparation of details & assembly drawings of** Valves- Air cock, Blow off cock, Steam stop valve, gates valve, globe valve, non-return valve, I.C Engine parts: piston, connecting rod, cross head and crankshaft.	08
Module 06	**Preparation of details & assembly drawings of** Jigs and fixtures.	06
	Limits fits and tolerances dimensioning with tolerances indicating various types of fit in details and assembly drawings	

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.

Practical Examination:

Practical examination will be based on part B of the Term work

Term Work: Term Work:

A. Total 4 numbers of half imperial drawing sheets

1 Sheet on Module 1minimum 3 problems

1 Sheets on details to assembly of any two topics from Module 2

1 Sheets on details to assembly of any two topics from Module 3

1 Sheet on assembly to details of any unit topics from Module 4

1 Sheets on details to assembly of any two topics from Module 5

1 Sheet detail- assembly of Module 6 with fits and tolerances

B. **Practicals in AUTOCAD**

Computer aided drawing and designing of Assembly, joints, Gears, spring, shaft, pipe fittings, Bearings Jigs and fixtures, I.C. engine parts, pulleys and belts, Limits, fits and tolerances, Rivets ,Preparation of 2-D drawings for machine components (bolts, nuts, flange coupling, connecting rod,) - 3-D modeling - solid, surface, wire frame using standard CAD packages , creation of 2-D drawings from 3-D models using CAD packages, different views, sections, isometric view and dimensioning them - Parametric modeling, creating standard machine parts, connecting rod, flange coupling,.

Minimum Four Print out of problems solved in the practical class to be attached in the Term work (module 2 to 6)

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

- Journal containing of drawing sheets ..... (10) Marks.
- Test (at least one): ..... (10) Marks.
- Attendance (practical & theory): ..... (05) Marks.

TOTAL: ..... (25) Marks.

Reference Books:

i. Machine Drawing By N. D. Bhatt.
ii. A text book of Machine Drawing By Lakshminarayan & M. L. Mathur. (Jain brother,Delhi).
iii. Machine Drawing By Kamat & Rao.
iv. Machine Drawing By M. B. Shah.
v. A Text book of Machine drawing By R. B. Gupta (Satya Prakasham Tech publication)
vi. Machine drawing By K.I.Narayana, P. Kannaiah, K. Venkata Reddy.
vii. Machine drawing with AutoCAD—Gautam Pohit and Gautam Ghosh (Pearson Education)
viii. Machine drawing By Ajeet Singh (Tata McGraw Hill)

CLASS: SE (Mechanical / Automobile) Semester-III

SUBJECT: PRODUCTION PROCESS - I

Periods per week 1Period of 60 min.	Lecture	4	
	Practical	--	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	--
	Term Work	--	25
	TOTAL		125

Sr. No.	Details	Hrs.
Module 01	Classification of Manufacturing Process, Ferrous and non-ferrous metals and their alloys used in engineering, their properties and uses. Manufacturing of pig iron, cast iron , wrought iron and steels. **Remelting furnaces:** such as Cupola, pit-furnace oil fired, gas and electric furnaces, their size, capacity, suitability, construction and working. **Pattern making and Foundry**: Materials used for pattern making, Types of pattern, Pattern allowances, core box, core prints and cores. **Moulding Methods**: Hand and Machine moulding techniques Principle of gating, principle of risering, solidification of casting. Defects of casting and inspection of casting.	12
Module 02	**Lathes**: type of lathes, their construction and working, operation of lathes, screw cutting on C lathe, attachments and accessories used on lathe, type of tools, cutting speed, feed, depth of cut and machining time. Capstan and turret lathes, tooling for simple jobs Elementary treatment of modern lathe such as single spindle and multi-spindle Automats. NC and CNC machines, machining centers.	06
Module 03	**Milling Machines**: types of machines, horizontal, universal, vertical, Cutters and their applications, Operation on milling machines, Use of dividing head and circular table. Direct, simple, compound, differential and angular indexing and helical milling operation. Table feed in milling. Work holding devices.	06
Module 04	**Drilling Machines**: Types of machines, Types of drillings, operations such as drilling, boring, reaming, spot facing, counter boring, counter sinking and tapping. Drill speeds and feeds. Plaining machines, shaping machines and slotting machine: Various types, construction and working, operations and tools, field of application, quick return mechanism and feed mechanisms of these machines. **Grinding:** Grinding machines such as pedestal, cylindrical surface, centre less and tool and cutter grinder. Operations on the above mentioned machines. Grinding wheel, selection and specifications. Dressing and truing of grinding wheels. Finishing operations such as lapping and honing.	10
Module 05	**Welding And Joining Processes**: Riveting, soldering and brazing. Fusion welding, gas and arc welding, sub merged arc welding – insert gas welding – Electric slag welding – CO_2 welding – thermit welding. Welding Equipments. Pressure welding – solid phase welding – resistance welding, friction welding. Process capability and applications. Weld joints- types edge preparations – welding fixtures. Weldability – designs, process and metallurgical considerations – testing and improvement of weldability – microstructure of weld – welding defects.	08
Module 06	**Powder Metallurgy** Principle, process, applications, advantages and disadvantages of powder metallurgy. Processes of powder making and mechanisms of sintering. **Non-Destructive Techniques** Dye Penetrant, Magnetic, Electrical, Ultrasonic and Radiographic non-	06

destructive testing methods.

Non conventional machining processes:

(Only basic principles, machines and application) :Electrical discharge machining (EDM).Electrochemical machining (ECM) .Ultrasonic machining (USM) .Laser beam machining (LBM).Electron beam machining (EBM). Plasma arc machining (PAM)

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 06 assignments covering all the topics and a class test. The distribution of marks for term work shall be as follows:

- Assignments: ..... (10) Marks.
- Test (at least one): ..... (10) Marks.
- Attendance (Theory): ..... (05) Marks.

TOTAL: ..... (25) Marks.

Text Books:

Workshop Technology By W. A. J. Chapman part I, II & III

A Textbook of Foundry Technology by M. Lal

Production Technology by R. C. Patel and C. G. Gupta Vol I, II

Manufacturing Processes & materials for Engineers by Doyle.

Production Technology by HMT

Production Technology by Raghuvanshi

Production technology by Jain & Gupta.

Elements of workshop Technology Hazra Chaudhary Vol I, II.

Manufacturing Process by Roy A. LINDBERG.

Semester-III

CLASS: SE (Mechanical / Automobile)

SUBJECT: THERMODYNAMICS

Periods per week 1Period of 60 min.	Lecture	4	
	Practical	--	
	Tutorial	1	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	25
	Term Work	--	25
	TOTAL		**150**

Sr. No.	Details	Hrs.
Module 01	**Thermodynamic concepts**: System, surrounding, state, path, property, Reversible and irreversible process, thermodynamic work, heat, temperature, thermal equilibrium, Zeroth law of thermodynamics. **First law of Thermodynamics**: Statement. First law applied to non-cyclic process, Internal energy. Application non flow processes viz. Constant volume, constant Pressure, and constant temperature, adiabatic and polytrophic processes. Heat and work calculations. Application of First law to open systems, flow work, Steady flow energy equation, Work done in steady flow processes in terms of pressure and volume. Throttling process. Joule's porous plug experiment. Joule-Thompson coefficient, SFEE applied to boiler, nozzle, condenser etc.	8
Module 02	**Second law of thermodynamics**: Limitations of first law of Thermodynamics. Heat engine, thermal efficiency, reversed heat engine, coefficient of performance, Kelvin-Planck and Clausius statements and their equivalence. Carnot cycle, Carnot's theorem, Thermodynamic temperature scale.	8
Module 03	**Entropy**-Clausius inequality, Entropy changes for an ideal gas during reversible process, Entropy of isolated system in real processes. Principle of increase of entropy. **Introduction to Availability:** Available and Unavailable energy. AE when heat is withdrawn from a finite reservoir and when heat is withdrawn from an infinite reservoir. Irreversibility.	8
Module 04	**Properties of steam**: Dryness fraction, enthalpy, internal energy and entropy. Steam table and Mollier chart. First law applied to steam processes.	6
Module 05	**Power Cycles**: Vapour power- Rankine cycle, Modified Rankine cycle for improved performance (Reheat, regenerative) **Gas power**- Thermodynamics of Otto, Diesel, semi-Diesel and Brayton cycle. Comparison and representation on P-V, T-S diagram.	8
Module 06	**Thermodynamics of Fluid flow (One dimensional):** Propagation of sound waves through compressible fluids, Sonic velocity and Mach number. Application of continuity, momentum and energy equations for steady state conditions. Steady flow energy equation applied to nozzle. Isentropic flow through ducts of varying cross-sectional area. Effect of varying backpressure on nozzle performance. Area ratio Critical pressure ratio. Normal shock, basic equations of normal shock, change of properties across normal shocks. Rayleigh and Fanno lines. Adiabatic flow through constant area duct with friction.	10

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 20 problems covering all the topics and a class

- Tutorial work (Numerical/assignments): (10) Marks.
- Test (at least one). ..... (10) Marks.
- Attendance (Practical & Theory): ..... (05) Marks.

TOTAL: ..... (25) Marks.

Oral Examination:

Oral examination will be based on the term work.

Text Books:

1. Engineering Thermodynamics M. A. Saad, Macgraw Hill.
2. Engineering Thermodynamics R. K. Rajput, Lakshmi Publication.
3. Applied Thermodynamics T. D. Eastop and A. McConkey, Addition – Wesley
4. Fundamentals of Compressible fluid flow S. M. Yahya.
5. Thermodynamics J. P. Holman, Macgraw Hill.
6. Engineering Thermodynamics P. K. Nag, Tata Macgraw Hill
7. Fundamentals of Thermodynamics Sonntag, Wiley India

References:

1. Thermodynamics W. C. Raynold, Macgraw Hill and NY.
2. Engineering Thermodynamics Mayhew Y R Rogers GFC – Orient Longman
3. Engineering Thermodynamics M. Achutan, PHI
4. Engineering Thermodynamics J. B. Jones and Dugan, PHI.
5. Thermal Engineering Ballaney.
6. Thermodynamics and Engg. Approach Yunus and Cengel, McGraw Hill, Inc.
7. Engineering Thermodynamics Lyndd Russell, George A Adebiyi Oxford Press.

CLASS: S.E (Mechanical Engineering) **Semester - III**

SUBJECT: Presentation and Communication Techniques

Periods per week	Lecture	2	
	Practical	2	
(each of 60 min.)	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	--	--
	Practical examination	--	--
	Oral Examination	--	--
	Term Work	--	50
	Total		50

Detailed Syllabus		Lectures/Week
1	**Communication in a business organization:** Internal and external communication, Types of meetings, strategies for conducting successful business meetings, documentation (notice, agenda, minutes, resolution) of meetings. Introduction to modern communication techniques. (e-mail, internet, video-conferencing, etc.) Legal and ethical issues in communication (Intellectual property rights: patents, TRIPS, Geographical indications).	06
2	**Advanced technical writing:** Report writing: Definition and importance of reports, qualities of reports, language and style in reports, types of reports, formats (letter, memo, project-repots). Methods of compiling data for preparing report. A computer-aided presentation of a technical project report based on survey-based or reference based topic. The topics are to be assigned to a group of 8-10 students. The written report should not exceed 20 printed pages. Technical paper-writing, Writing business proposals.	08
3	**Interpersonal skills:** Introduction to emotional intelligence, motivation, Negotiation and conflict resolution, Assertiveness, team-building decision-making, time-management, persuasion	04
4	**Presentation skills:** Elements of an effective presentation, Structure of a presentation, Presentation tools, Audience analysis, Language: Articulation, Good pronunciation, Voice quality, Modulation, Accent and Intonation.	04
5	**Career skills:** Preparing resumes and cover letters. Types of Resumes, Interview techniques: Preparing for job interviews, facing an interview, verbal and non-verbal communication during interviews, observation sessions and role-play techniques to be used to demonstrate interview strategies (mock interviews).	04

6	Group discussion group discussions as part of selection process. Structure of a group discussion, Dynamics of group behavior, techniques for effective participation, Team work and use of body language.	04

Term work: Part-I (25 Marks): Assignments;

2 assignments on communication topics

3 assignments on report-writing

3 assignments on interpersonal skills

2 assignments on career skills

At least one class test (written)

Distribution of term work marks will be as follows:

Assignments : 10 marks

Written test : 10 marks

Attendance (Theory and Practical) : 05 marks

Term work: Part-II (25 Marks): Presentation;

Distribution of term work marks will be as follows:

Project report presentation : 15 marks

Group discussion : 10 marks

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Books recommended:

1. Fred Luthans: Organizational behavior, McGraw Hill
2. Lesikar and Petit, Report writing for business, Tata McGraw Hill
3. Huckin & Olsen, Technical writing and professional communcation, McGraw Hill
4. Wallace & Masters, Personal development for Life & work, Thomson Lerning.
5. Heta Murphy, Effective Business Communication, McGraw Hill
6. Raman and Sharma, Report writing.

CLASS: SE (Mechanical / Automobile) Semester- III

SUBJECT: **MACHINE SHOP PRACTICE I**

Periods per week 1Period of 60 min.	Lecture	--	
	Practical	3	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	--	--
	Practical	--	--
	Oral Examination	--	--
	Term Work	--	50
	TOTAL		**50**

Term Work:

1. One job on plain and taper turning.
2. One job on prevision turning, taper turning and screw cutting.
3. One job on shaping machine to make horizontal and inclined surfaces.
4. Two jobs on forging of cutting tools use on lathes.
5. One simple exercise on welding – preparing a component compressive welding joints.

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

- Laboratory work (experiments): ..... (40) Marks.
- Attendance (practical): ..... (10) Marks.

TOTAL: ..... (50) Marks.

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.	
Module 02	2. **Partial Differential Equations**	12
	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.	
Module 03	**3. Random Variables:**	02
	3.1 Discrete and continuous random variables, probability mass function and density function. Probability distribution for random variables. Expected value, Variance.	
Module 04	**4. Probability distributions:**	08
	4.1 Binomial, Poisson and Normal Distributions.	
Module 05	**5. Sampling theory:**	07
	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.	
Module 06	**6. Fitting of curves:**	05
	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.	

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

Semester- IV

CLASS: SE (Mechanical / Automobile)

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**	10
	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	
Module 02	**Velocity and Acceleration analysis of mechanism (mechanisms up to 6 links).**	10
	2.1 Velocity analysis by instantaneous centre of rotation method (Graphical approach)	
	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:**	7
	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	

Module 04 Static & Dynamic force analysis of plane mechanisms: 7

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 system 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.

Module 05 Flexible Connectors: 6

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.

Module 06 Gears 8

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 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.

Total: ..... 25 Marks.

CLASS: SE (Mechanical / Automobile) Semester-IV

SUBJECT: **THERMAL ENGINEERING**

Periods per week 1Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	--	
Evaluation System		Hours	Marks
	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 PRODUCTION PROCESS -II

Periods per week 1Period of 60 min	Lecture	4	
	Practical	2	
	Tutorial	--	
Evaluation System		Hours	Marks
	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 05	**Sheet-metal Working:-** Elementary treatment of press working, operation on presses ,press devices and classification of presses, design of blanking, 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.	10
Module 06	**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: **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.**	8

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. Recrystailation temperature. Hot and cold working theory. Their advantages, limitations and applications.

Module 02	**Fracture**	8

Definition and types of facture.

Brittle fracture. Griffth's terry 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. Con fitions of ductility transition factors affecting it.

Fatigue Failure:

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.

Creep

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.

Module 03 **Theory of Alloys& Alloys Diagrams** 6

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 carbon in Iron-Carbon alloying.

Iron- Iron carbine diagram and its analysis.

Module 04 **Heat treatment Process:** 6

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.

Module 05 **Surface Hardening & Diffusion Coating Processes** 4

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.

Module 06 **Effect of Alloying Elements in Steels:** 4

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.

Strengthening Mechanism:

Theory and applications of strain hardening, Age hardening, Precipitation hardening and Dispersion hardening.

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

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 Stoughton, 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: 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	**Thyristors and their Applications**	08
	1.1 Introduction	
	1.2 Applications	
	1.3 Symbolic Representations	
	1.4 Specification	
	1.5 Principal of Operation of 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	
Module 02	**Invertors, Choppers, Converters**	08
	2.1 Commutation circuits	
	2.2 Inverters: series and parallel	
	2.3 Choppers: Step-up, Morgan's, Jones's	
	2.4 Single phase and three phase Converters	
Module 03	**3.1 Solid State** Control of D.C. Motors	10
	Introduction	
	Advantage of Electronic Control	
	D.C. Motor Speed Control	
	Speed Control of D.C Shunt Motors using Thyristors	
	Over-voltage Protection of D.C. Motors	
	Overload Protection of D.C. motors	
	Closed loop control	
	3.2 Solid State Control of A.C. Motors	
	Introduction	
	A.C. Motor Control	

Speed Control of Motors

Speed Control of A.C Shunt Motors using Thyristors

Module 04	**Operational Amplifier 741 & ICNE 555**	08

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, Bistable Multivibrators, Timing circuits.

Module 05	**Digital Electronics**	08

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

Module 06	**Introduction to 8085 Microprocessor**	06

Architecture, Instruction sets, simple program writing, Interfacing with memory and Input/Output devices, Applications.

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 / Fan Control using SCR
5. Characteristic of a Triac
6. Application of a Triac for Illumination Control
7. Firing circuit using Unijunction Transistor
8. SCR Controlled Emergency Light
9. Speed Control of D.C. Shunt Motor using SCR
10. Study of Integrator using OPAM 741
11. Study of Differtiateor using OPAM 741
12. Study of Adder using OPAM 741
13. To Run a simple program on Microprocessor 8085 such as addition etc.
14. Study of a Three phase rectifier using Power diodes.
15. 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 entire 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 performance & writing, assignments and written test in the form of journal. The distribution of marks for term work shall be as follows:

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

TOTAL: ..... 25 Marks..... 25 Marks.

Text Books:

1. Thyristors and its applications by Ramamurthy ,East-West New Delhi.
2. S.K Bhattacharya/S Chatterjee, Tata McGraw Hill Publishing Company Limited
3. Industrial Electronics, by James Humphries, Leslie Sheets, 4e-Delmar Publication
4. Industrial Electronics by Biswanth Paul PHI
5. Industrial Electronics for Technicians – by J.A. Sam Wilson Joseph Rissi, Prompt Publication
6. Modern digital electronics – by R. P. Jain Mcgraw Hill Publication
7. Op-amp and linear integrated circuits by Gaikwad, Eastern co. edition, PHI
8. Introduction to 8085 Micrporcessor by Gaonkar, Wiley Eastern
9. Power Electronics by P. C. Sen,TATA Mcgrawhill, New Delhi
10. Digital electronics by Malvino Leach, TATA Mcgrawhill, New Delhi

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.