SEMESTER-III

Sr. No.	Subjects	Lectures	Practicals	Duration of Theory Paper (Hrs)	Theory Paper	TermWork	Practical	Oral	Total
1.	Applied Mathematics-III	4	--	3	100	--	--	--	100
2.	Strength of Materails	4	1.5	3	100	25	--	--	125
3.	Industrial Electronics	4	1.5	3	100	25	--	--	125
4.	Machine Drawing	3	4	4	100	50	--	--	150
5.	Production Processes	4	-	3	100	-	-	-	100
6.	Applied Thermodynamics	4	-	-	100	-	-	-	100
6.	Machine Shop Practice	-	-	-	-	50	50	-	100
Total		**23**	**10**	**15**	**600**	**150**	**50**	**-**	**800**

MECHANICAL& AUTO ENGG. BRANCH

APPLIED MATHEMATICS - *III*

1 Complex Variables : Functions of complex variable. Continuity (only statement) derivability of a function Analytic. Regular Function. Necessary conditions for the function to be analytic. (Statement of sufficient conditions). Cauchy Riemann equation in polar co-ordinates. Hamonic functions, orthogonal trajectories. Regions and paths in the z-plane. Path/Line integral of a function. Inequalities conditions for the path integral to be independent of the path joining two points. Contour integral. Cauchy's theorem for analytic function with continuous derivative.

2. Vector Calculus : Scalar and vector point functions. Directional derivative, Level surfaces, gradient. Surface and volume integrals. Definitions of curl, divergence. Use of operator, Conservative, irrotational, Solenoidal fields. Green's theorem for plane regions

and properties of line integral in a place. Statements of Stoke's theorem. Gauss's divergence theorem, related identities, deductions.

3. <u>Partial Differential Equations</u> : Partial differential equation governing Transverse Vibrations of an elastic string, its solution using Pabular Series. Heat Equation, Steady-state configuration for heat flow and Laplace equation in two and three dimensions.

4. <u>Laplace Transforms</u> : Function of bounded variation (statement only) Laplace transforms of $I, t^n e^{80}$ sin (at), cos (at), sinh (at), cosh (at) shifting properties. Expressions (without proofs) for unit step functions and their Laplace transform, Laplace transform of periodic functions. Application to solve initial and boundary value problems involving ordinary differential equations with one dependent variable.

5 <u>Statistics, Probability and reliability</u> : Frequency distribution, Measures of central tendency, Mean, Median and Mode, Measures of variability, Range Percentiles, Variance, Standard Deviation, Skewness, Moments, discrete random variables and their probability distributions. Binomial and Poisson's distributions, continuous random variables. Normal distribution. Properties of Normal distribution, coefficient of Correlation. Lines of Regression - Rank Correlation. Test of significance. Theory of Probability and Reliability.

<u>Books Recommended;</u>
(i)   Elements Of Applied Mathematics. Vol. I / Vol. II P. *N. Wartikar J. N. Wartikar*
(ii)   Engineering Mathematics: Vol. II Pentice Hall of India, Second Edition 1994. S. S. *Sastry*
(iii)   Matrices.   *Vasistha*
(iv)   Complex Variable   *J.N.Kapur*
(v)   Matrices.   *Churchil*
(vi)   Theory Of Functions Of Complex Variables.:   *Shanti Narayan*
(vii)   Laplace transforms   *Shanti Narayan (Schaum's outline series)*
(viii) Basic Mathematics for College students by Alien Tussy   *Thomson Learning*
(ix)   College Mathematics through Applications.   *JohnCPeterson William JWagner Stephen S Williou Delmar Publications.*

<u>STRENGTH OF MATERIAL</u>

1. <u>Simple Strees and gauge</u> : Stress Strain, modulus of elasticity, modulus of rigidity, bulk modulus, yield stress, ultimate stress, factor of safety, shear stress, Poisson ratio, bars of varying sections, composite sections, temp stress.
2. <u>S. F. and B. M. in beams ;</u> Axial force, shear force and bending moment diagrams of

statically determinate beam including beams with internal hinges for different types of loading, relationship between rat of loading shear force bending moment.

3. <u>Simply theory of bending moment</u> : Flexure formula for straight beams, Moment of Inertia, Product of Inertia and Polar moment of Inertia of Planes areas, principle axes of inertia, moments of Inertia about principle axes, transfer theorem. Simple problems involving application off flexure formula, section modulus, moments of resistance of a section, flexural stresses in beams subjected to oblique bending of un symmetrical sections, beams of uniform strength, leaf springs.

4. <u>Shear stress in beams ;</u> Distribution of shear stress across plane sections used commonly structural purposes, shear connectors, shear stresses, and flow in beams of thin walled open cross sections, shear center of thin walled section such as angle, Tee channel and I-section.

5. <u>Simple theory of torsion</u> : Torsion of circular shafts-solid and hollow, stresses in shaft when transmitting power close coiled helical springs under axial load.

6. <u>Bending Moment   combined with Torsion and   axial loads</u> :
Application to members subjected to acentric loads, core of section, problems on chimneys, shaft etc.

7. <u>Principle stress</u> : General equations for transformation of stress, principle planes and principle stresses, maximum shear stress, determination using Mohr's circle, maximum Principle & max. shear stress theory of failure.

8. <u>Deflection of Beams</u> : Deflection of cantilevers, simply supported and overhanging beams using double integration & Macaulay's methods for different types of loadings.

9. <u>Strain energy</u> : Strain energy due to axial force and bending moment, stresses in axial members and simple beams due to impact loading.
Stress and Strain in thin Cylinder and spheres due to internal pressure.

10. <u>Influence lines for beams</u> : IL for support reactions and S.F. and B.M. at any given section, Calculation of S.F. and B.M. due to rolling loads. (Point loads and UDL only), Calculation of absolute B.M. in simply supported beam.

11. <u>Bending of curved bar</u> : flexural stresses in beams with initial curvature.
Application to crane hooks chain link & rings.

<u>Practicals; List of Experiments: -</u>
1.   Tension test on mild steel bar (stress-strain behavior, modules determination)
2. Test on for steel bar (tension, bend & re-bend).
3. Test on cast iron (transverse, tension)
4. Shear test on mild steel, cast iron, brass
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. ix & x)

Term Work :
•   Each student is to appear for at least one written test during the term. (10 marks)

• Report on experiments performed as detailed above and the graded answer paper of the term test shall be submitted as term work.(15 marks)

Books Recommended ;
1. Mechanics of Materials by *EPPopov,* Prentice Hall of India Pvt. 1978.
2. Theory of Elastic Stability by *Timoshenko & Gere,* Tata McGraw Hill Book Publishing Co. Ltd. 1985
4. Engineering Mechanics by *Timoshenko & Young,* Tata McGraw Hill Book Publishing Co. Ltd. 1985
4. Mechanics of Structure by S.B. Jimna/car,Charotar Publishers
5. Mechanics of Marterial by *James Gero -* Thomson learning
6. Mechanics of Materials by *Ferdin* and *P. Beer E. Russell* Johns/on, *Jr. John T.* Dewolf Me Graw International.
7. Strength of Materials by *S. Ramamruthum.*

INDUSTRIAL ELECTRONICS

1. Thyristors and Their Application
1.1. Introduction
1.2 Applications   1.3 Symbolic Representations
1.4 Specifications   1.5 Thyristor Ratings
1.6 Thyristor Construction   1.7 Principle of operating of an SCR
1.8 Two-Transistor Analogy of SCR   1.9DIAC
1.10 TR1AC   1.11 Unijuntion Transistor (UJT)
1.12 Rectifier Circuits using SCR
1.13 Solid State Switching Circuits using Thyristors
2 Introduction to Microprocessors
2.1 Architecture of Intel 8085Microprocessor
2.2 Instruction   Set of 8085   Microprocessor & simple Prograr   writing
2.3 Interfacing a Microprocessor with Memory and Input/Ooutpu   Devices
2.4 Applications of Microprocessors
3. Inverters, Choppers, Dual Converters and Cycloconverters
3.1 Inverters   3.2 Choppers   3.3 Dual Converters
4 Solid State Control of d.c. and a.c. Motors
4.1 Introduction   4.2 Advantages of Electronic Control of Devices
4.3 d.c. Motor Speed Control
4.4 Speed Control of d.c. Shunt Motors using Thyristor Technology
4.5 Over-voltage protection of d.c. motors
4.6 Overloading protection of d.c. Motors.
4.7 An a.c. Motor control   4.8 Speed Control of Types of Motors
5 Amplifiers   5.1 Magnetic Amplifiers
5.2 Thyratron & Thyratron Amplifier   5.3 Operational Amplifier

Laboratory Experiments:
1. Firing Characteristic of an SCR
2. Half-Wave Gate con trolled Rectifier using one SCR
3. Single-phase Half controlled Ful-wave Rectifier using Two SCRs and Two Diodes.
4. Illumination Control using SCR
5. Firing Characteristic of aTriac
6. Application of a Traic for Illumination Control
7. Unijuction Transistor Characteristic
8.   SCR Controlled Emergency Light
9.   LDR Application in a Light Activated Turn-Off Circuit
10. Speed control of a d.c. Shunt Motor using SCR
11. Study of a Three phase Rectifier using Power Diodes
12.   Study of an Electronic Timer using ICNE -555

Term Work
•   Each student is to appear for at least one written test during the term, **(10 marks)**
•   Report on experiments performed as detailed above and the graded answer paper of the term test shall be submitted as term work. (ISmarks)

Books Recommended:
1.   S.K.Bhattacharya/S.Chatterjee, *Tata McGraw-Hill Publishing company Limited*
2.   Industrail Electronic, *by James Humphries, Leslie Sheets,* 40- Delmar Publications
3.   Industrial Electronic *by Biswanath Paul PHI*
4.   Industrial Electronic for Technicians - *by J.A.Sam Wilson Joseph Rissi$_t$* Prompt Publications

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MACHINE DRAWING

1. Solid Geometry :
1.1   Intersection of surfaces and interpretation of solids-intersection of prism or cylinder with Prism Cylinder or cone both solids both in simple position only.
1.2   Primary auxiliary views and aux. projections of simple machine pants.
2. Machine Drawing
2.1   Machine Elements
2.1.1   Free hand sketches of M/C elements such as bolt, nuts, washers, studs, tapped holes
2.1.2   Conventional representation of assembly of threaded parts in external and sectional views
2.2   Detail and Assembly drawing: Introduction   to units assembly drawing steps   involved in preparing assembly drawing from details and vice versa.

2.3   Preparation of details & assembly drawings of following units.
2.3.1   Cotter, Knuckle joint
2.3.2   Keys and couplings, keys-sunk, parallel, woodruf saddle, feather etc. Coupling -simple, muff, flanged protected flanged coupling, oldhem's coupling, universa coupling.
2.3.3   Bearings-simple, solid, bushes pedestal fool step. I.S. conventional representation of ball and roller bearings
2.3.4   Pulleys-flatbelt, V-belt, rope belt fast and loose pulleys
2.3.5   Pipe joints: flanged joints-spigot and gland and stuffing box, expansion joint
2.3.6   valves-gate valve, globe valve, non-return valve
2.3.7   1C.Engine parts : piston, connecting rod, and crankshaft
2.3.8   Jigs and fixtures
2.4   Limits fits, and tolerance dimensioning with tolerance indicating various types of fit in detail and assembly drawings

TERM-WORK
(a)   Total 6 numbers of half imperial drawing sheets
(b)   1 -sheet on para 1.1 minimum 3 problems
(c)   1 -sheet on para 1.2,2.11,2.1.2 minimum 3 problems
(d)   2-sheet on details to assembly of any two units topics from 2,3.1,to2.3.7
(e)   1 Sheet on assembly to details of any unit topics from 2.3.1 to 2.3.7
(f)   1   sheet detail-assembly of unit para 2,3,8, with fits and tolerances

NOTE;
In the examination questions related to assembly drawing should be limited to the unit Consisting of not more than 12 parts including standards items.

Books Recommended;
1.   Machine Drawing by *N.D.Bhatt.*
2.   **A text books of machine Drawing** by *Laximinarayan* & ML. *Mathur(Jam* Brother New Delhi)
3.   Machine Drawing by *Kamat & Rao.*

Books Recommended;
i.   Machine Drawing *By M.B.Shah.*
ii.   **A text Book   of machine   drawing** *By R.B.Gupta (Satya Prakashan Tech India Publication)*

PRODUCTION OF PROCESSES-l

Classification of Manufacturing Process, Ferrous and non-ferrous metals and their alloys used in engineering their properties and uses. Heat treatment like Hardening,

tempering, annealing of steels (elementary level).

1. <u>Pattern making and foundry</u> : Materials used for pattern making, types of pattern, allowance ? Pattern core box core print and cores.

2. <u>Moulding methods :</u> Hand and Machine moulding techniques.

3. <u>Remalting furnaces :</u> Such as cupola, pit-furnance oil fired, gas and electric furnaces, their size, capacity, suitability, construction & working, Use of ladies, principle of gating, principle of risering, solidification of casting, Defects of casting and inspection of casting.

4. <u>Elementary treatment of wire drawing, metal</u> : spinning, power spinning, smithy and forging metal extrusion & Rotary swaging.

5. <u>Metal surface treatment</u> : Electroplating, galvanizing, anodizing, metal spraying.

6. <u>Lathes</u> : Types of lathes, their construction and working , operation of lathes, screw cutting on C. lathe, attachments and accessories used on lath, type of tools, cutting speed, feed, depth of cut and machining time. C upstain and turret lathes, tooling for simple jobs.
Elementary treatment of modern lathe such as single spindle and multi spin? automats, NC and CNC machining centres.

7. <u>Drilling Machines:</u> Types of machines, types of drillings, operations such as drilling, boring, reaming, spot facing counter-boring counter sinking, tapping, Drill speeds and feeds.

8. <u>Planing machine,   shaping Machine   and slotting machine</u>   :
Various type construction and working of machine operations tools, fields of application, quick return mechanism and feed mechanism of these machines.

9. <u>Milling Machines</u> : Type of Machines, horizontal, vertical, universal Cutters and their applications, Operation on milling machines. Use of dividing head and table, Direct, Simple compound, differential and angular indexing and helical milling operation.Table feed milling. Work holding devices.

10 <u>Grinding</u> : Grinding machines such as pedestal, cylindrical surface, centreless and tool and cutter grinder, operations on the above mentioned machines. Grinding wheel, selection and specification. Dressing and triuing of grinding wheels.
Finishing operations. Such as lapping and honing.

11. <u>Welding And joining Processes</u> : Riveting, soldering and brazing. Fusion welding gas and arc welding, submerged arc welding -inert gas welding = Electric slag welding -CO(2) Welding - Thermit welding, Welding equipment's. Pressure welding - solid phase welding -resistance welding - friction welding - other miscellance welding processes and equipments, process capability and application. Weld joints - types- edge preparations welding fixtures. Weldability - design, process and metallurgicalconsiderations - testing and improvement of weldability - micro structure of weld -welding defects.

12. <u>Plastic Moulding</u> : Different plastic materials, properties and Uses, moulding procedures. Design of Injection moulding, compression moulding, transfer moulding and blow moulding, extrusion of Plastics, Plastic moulding equipment's and their selection.

13. <u>Powder metallurgy</u> : Principle, process, application, advantages and disadvantages of powder metallurgy, Processes of powder making and mechanism of sintering.

14. Metallurgy of Metal joining;

Metallurgy of welding, Brazing and Soldering. Welding defects and their remedies. Welding of stainless steels.

15. Non-Destrcutive Technique : Dye Penetrant, Magnetic, Electrical, Ultrasonic and Radiographic non-destructive testing methods.

Books Recommended :
(1)   **Workshop Technology** by *W.A.J.Chapman* Part I, II & III,
(2)   **A Textbook of Foundary Technology by M. Lal.**
(3)   **Production Technology** by *R.C. Patel* and *C.G.Gupta* Vol.1 & II.
(4)   **Manufacturing Processess & materials for Engineers**   by *Doyle.*
(5)   **Production Technology** By *HMT*
(6)   **Production Technology** by *Jain and Gupta*
(7)   **Elements of Workshop Technology**   by *Hazra Choudhary* vol. I & II.
(8)   **Manufacturing Process** by *Roy A. LINDBERG*

APPLIED THERMODYNAMICS

i- Thermodynamic concepts : System, surrounding, state, path, property, Reversible and irreversible process thermodynamic work, heat, temperature, thermal equilibrium, Zeroth law of thermal dynamics.
2. First law of thermodynamics : Statement First law applied to non-cyclic process, Internal energy, Application non flow processes viz. Constant volume, constant pressure, constant temperature, adiabatic and poly tropic process. Heat and work calculations.
Application of first law of 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-Thomson coefficient, sfee applied to boiler, nozzle, condenser etc.
3. Second law of thermodynamics : Limitations of first law of thermodynamics, heat engine, thermal efficiency, reversed heat engine, coefficient of performances, kelvin-planck and Clausius statement and their equivalence, Carnot cycle Carnot's therom, Thermodynamics temperature scale.
Entropy - Clausius inequality , Entropy changes for an *ideal* gas during reversible processes. Entropy of isolated system in real processes. Principle of increase of entropy.
4. Availability : Available and Unavailable energy, AE when heat is withdrawn from a finite reservoir and when heat is withdrawn from a finite reservoir. Availability of closed system and steady flow system irreversibility.
5. Properties of Steam ; Dryness fraction, enthalpy, internal energy and entropy, Steam table and Mollier chart, First law applied to steam processes.
6. 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. Comprision and representation on P-V.T.S. diagram.

7. 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 nozzles Isentropic flow through ducts of varying cross-sectional area. Effect of varying back pressure nozzle performance. Area ratio, critical pressure ratio.

Normal shock, basic equations of normal shock, change of properties across normal shock. Rayleigh and Fanno lines, Adiabatic flow through constant area duct with friction.

Recommended Books:

1.   Thermodynamics by   *W.C.Reynolds,* McGraw-Hill, NewYo 1969.

2.   Engineering   Thermodynamics   by   *Mayhew   Y.R.   a Rogers G.F.C.* - Orient Longman, 1967.

3.   Thermodynamics by *J.P.Holeman,* McGraw-Hill, 1974.

4.   Engineering Thermodynamics by *M.A.Saad,* McGraw-H 1976.

5. Thermal Engineering by *R. K. Rajput.*

6. Thermal Engineering by *Ballaney*

7. **Engineering Thermodynamics** by *J. B. Jones* and *Dugan PHI*

8. Engineering Thermodynamics by *MAchutan* PHI

9. Fundamentals of Compressible Fluid Flow by *Yahyha.*

MACHINE SHOP PRACTICE

1   One job on plain and taper turning.

2.   One   job   on   prevision   turning,   taper   turning   an screw cutting.

3.   One   job   on   shaping   machine   to   make   horizontal and inclined surfaces.

4.   Tow job on forging of cutting tools used on lathes.

5.   One   simple   exercise   on   welding-preparing component comprising welding joints.

Term work

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

Practical Examination ;

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