MECHANICAL ENGINEERING

Total Marks: 100

1. Manufacturing Technology: 25 Marks

Lathe -Construction- Various Operations- Taper Turning Methods- Lathe Attachments & Accessories- Capstan and Turret Lathes – Automats – Single Spindle- Swiss Type- Multi Spindle Automatic lathe.

Theory Of Metal Cutting- Chip Formation, Orthogonal Cutting- Oblique Cutting- Cutting Tools-Single point Cutting Tool Geometry-Cutting Tool Materials, Tool Wear, Tool Life, and Cutting Fluids-Functions and properties.

Drilling - operations- Twist drill geometry –Radial drilling machine.

Milling-Classification - Milling cutters and classification-Fundamentals of milling processes-Milling operations. Indexing methods-Simple and compounding. Cutting speed, feed, depth of cut and machining time.

Shaping- Various shaper operations- Planer -Principal parts and Various planer operations

Grinding- Abrasive Processes- Grinding Wheel – Specifications And Selection, Types Of Grinding Process – Cylindrical Grinding, Surface Grinding, Centre less Grinding–Super finishing process-Honing, Lapping, Super Finishing, Polishing And Buffing.

Unconventional Machining Process - Electron Beam Machining, Laser Beam Machining, Electric Discharge Machining, Ultrasonic Machining, Abrasive Jet Machining.

Casting- Moulding Sands- Patterns- Casting Processes- Special Casting Techniques.

Welding Techniques: basic working principles of -Arc Welding- Gas Welding- TIG- MIG-Resistance Welding.

Rolling-Hot and cold rolling- Sheet Metal Operation-Shearing, Blanking, Punching, Trimming, Drawing, Embossing- Powder metallurgy.

CNC part programming- Structure of part programme- -Preparatory function (G)-Miscellaneous function(M).

Robotics- Structure of a robot-Applications of industrial robot.

Jigs and Fixtures- Definition-Need of Jigs and Fixtures

Basics of Drawing- Conventions- Types of lines- Dimensioning-systems of dimensioning - Surface finish symbols.

2. Strength of Materials and Theory of Machines: 17 marks

Simple stresses & strains: viz. tensile, compressive, Shear, & corresponding strains, Hook's Law – factor of Safety. Elastic Constants - Lateral Strain ,Poisson's ratio, Bulk Modulus, Shear Modulus, Rigidity modulus.(Simple problems only on stress and strain, young's modulus).

Centre of Gravity& Moment of Inertia : its Importance -Parallel & Perpendicular Axis Theorem- C.G of Rectangle, Triangle, Circle, Semi-circle, Trapezium, Cone(Only formulae)- Moment of Inertia of solid & Hollow sections like Rectangle, Triangle, Circle. (Only formulae).

Shear Force and Bending Moment: Definition -Types of beams, types of load acting on beams- Concept of Maximum bending moment- Drawing S.F & B.M Diagram for Cantilever, Simply Supported Beams subjected to Point Load and U.D.L (No problems)

Torsion & bending :Introduction - Angle of Twist - Polar Moment of Inertia - Torsion equation- Assumptions in theory of Torsion -Power Transmitted by a shaft. (No problems)

Bending- Introduction, assumptions in theory of simple bending.-Bending stress. (No problems)

Basic Kinematics of Machines- Four bar chain-mechanism and inversion.

Transmission of power: Introduction to Belt Drives-types of flat belt drives-open& cross- idler pulley- cone pulley- fast and loose pulley. Velocity Ratio- Slip and creep of belt. Rope drive- applications- Chain drives-types- advantages-Gear drives- Classification of Gears-applications of different gears. Gear Trains-Types of Gear trains –Simple, Compound, Reverted and Epicyclic gear trains- applications (Only problems on velocity ratio of belts and gears).

Friction-Introduction-Types of Friction, Laws of solid friction, coefficient of friction, limiting angle of friction, angle of Repose. (No problems)

3. Thermal Engineering: 17 MARKS

Thermodynamic systems – closed, open and isolated systems with examples-Properties of system- Intensive and Extensive properties with examples.-Definitions for properties like Enthalpy (H), Entropy(s) Internal energy (U)- Specific heat at constant pressure(C_p), specific heat at constant volume(C_v)-, characteristic gas equation, - Universal gas constant, -Law of thermodynamics-Zeroth, first & second laws of thermodynamics. (No problems).

Thermodynamic processes- Constant pressure, Constant volume, Isothermal, Isentropic, Polytrophic, Free expansion and throttling processes & equations representing the processes. (No problems).

IC engine -definition-classification- - Working principle of Two Stroke petrol & Diesel engine - Working principle of Four Stroke petrol & Diesel engine. -Rope brake Dynamometer-Formulae for Brake power, Indicated power Mechanical efficiency, Indicated thermal efficiency, Brake thermal efficiency, Mean effective pressure-Air standard efficiency, Relative efficiency, Volumetric efficiency. (Only problems on BP, IP and Mechanical efficiency).

Gas turbine-Introduction-types-open & close cycle-applications.

Formation of steam: Wet steam-dry steam-superheated steam and its properties.

Air Compressors- types-single stage & multi stage -uses-applications.

Refrigeration: Vapour compression-vapour absorption refrigeration- unit of refrigeration- COP - types of refrigerants –properties.

4. Fluid mechanics and Pneumatics: **17 MARKS**

Properties of fluids-Fluid pressure-manometer-simple & Differential-Pressure gauges Types- Type of fluid flows-Bernoulli's equation-Limitations- venturi meter-orifice meter-hydraulic co-efficient-losses in pipes-Darcy's and Chezs equations-Hydraulic gradients-water hammer (No problems)

Pumps- classification of pumps – Need for priming of centrifugal pump–multistage centrifugal pump. Reciprocating pump-types- Air Vessel-Slip. Concept of Submersible pump (No problems)

Hydraulic systems- -. Components of Hydraulic systems- Vane pump, gear pump - Hydraulic Valves –Pressure control valves – pressure relief valve, Direction control valves - 3/2, 5/2 valves,- Sequence valves.-Flow control valves–Actuators- Linear Actuators – Cylinders - single acting, double acting - Hydraulic motors-Accumulators-Types.

Pneumatic system- Components of pneumatic system- working of FRL unit- Control Valves – Pressure regulating valves, Flow Control valves, Direction Control Valves.-Actuators - single acting and double acting - Air motors,- Pneumatic Symbols.

5. Management: **12 Marks**

Management-Henry Fayol's principles-organization types- Production and Productivity- Product Design and its Stages- Types of Production- Functions of Production- Planning and Control Department- Purchasing and its Procedure- methods of purchasing - Comparative statement-purchase order-Tender-Types of tender

Storekeeping- classification of stores - Functions of store keeper -Bin Card - Material Issue Requisition- Material Returned Note- Store ledgers . Inventory Management- Definition - functions of Inventory Control

Material Requirement Planning (MRP)-concept, applications -Just in Time (JIT)-concept benefits – FIFO(first in first out) concept-advantages.

Motivation-Leader and types-Logistics- Quality- Factors affecting quality Inspection-Types.

Total Quality Management-Meaning- Principles of total quality management-PDCA cycles-Quality Circles-definition-Function.

TQM Tools- Flow charts, Control charts, Histograms, Pareto charts, Cause and effect diagram-5-S-Kaizen, and Six-sigma

Quality Certification Systems- ISO 9000 series quality standards, QS14000– ISO 9000, ISO 9001,ISO9002,ISO9003 & ISO 9004- ISO9000 quality certification procedure.

Plant maintenance-Definition-Types of maintenance-Preventive maintenance- Break down maintenance.

Industrial safety –Meaning - Accident- causes for accident- Direct and indirect losses due to an accident- Safety department- role of safety officer

Environment - Definition and scope-Solid waste management- causes, effects and control measures of municipal solid wastes (hospital wastes, hazardous wastes and e-wastes)- Water conservation and rain water harvesting. Climate change- global warming, acid rain, ozone layer depletion

6.Material science and Measurements; 12 MARKS

Mechanical Properties: Mechanical properties of metals, properties and Uses of Pig Iron, Cast Iron , Steel, Copper, Aluminum, Lead, Zinc, Tin-Nickel and Iron.

Heat Treatment: Heat Treatment of Steel, Properties & Uses of Plastic, Ceramics, and Composite materials.

Measurements-methods-terms applicable to measuring instruments-Thread measurements-sine bar-plug gauges-ring gauges. Transducer- strain gauges-types-Proving ring-load cells-Tachometers-LVDT-optical-pyrometer-thermocouple-Hydrometer-density measurement-Hygrometer-liquid level sensors.

Interchangeability-limits and tolerance-fit and its classifications-system of fits-unilateral and bilateral system

REFERENCES

Sl. No	Contents	Reference Books
1	**Manufacturing Technology**	1. Rao, P.N., *Manufacturing Technology, Vol I & II*, Tata Mcgraw Hill Publishing Co., New Delhi, 1998 2. Seropekalpakjian, Steven R Schmid *Manufacturing Engineering and Technology*- Pearson Education-Delhi 3. Sharma, P.C., *A Textbook Of Production Technology – Vol I And II*, S. Chand & Company Ltd., New Delhi, 1996 4. HMT – *"Production Technology",* Tata Mcgraw-Hill, 1998 **5.** *Elements of Workshop Technology* Vol-I&II Manufacturing Process edition-By Hajra Choudry **6.** K.R.Gopalakrishna "Engineering Drawing" (Vol. I & II), Subhas Publications, 2014
2	**Strength of Materials and Theory of Machines**	1. Ramamurtham. S., *"Strength of Materials",* 14th Edition, Dhanpat Rai Publications, 2011 2. Khurmi R S, *"Applied Mechanics and Strength of Materials",* 5 Edition, S.Chandand company 3. Popov E.P, *"Engineering Mechanics of Solids",* 2nd Edition, Prentice-Hall of India, New Delhi, 2002. 4. Nash W.A, *"Theory and problems in Strength of Materials",* Schaum Outline Series, McGraw-Hill Book Co., New York, 1995. 5. Kazimi S.M.A, *"Solid Mechanics*", Tata McGraw-Hill Publishing Co., New Delhi, 2003. 6. Ryder G.H, *"Strength of Materials",* 3rd Edition, Macmillan India Limited, 2002. 7. Bansal R. K, "*Strength of Materials",* Laxmi Publications, New Delhi, 2012. **8.** Timoshenko S.P, *"Elements of Strength of Materials",* Tata McGraw-Hill, Delhi,
3	**Thermal Engineering**	1. A Text book of Thermal Engineering by R S Khurmi& J K Gupta S Chand publication 2. Thermal Engineering by P. L. Ballaney, Khanna. Publishers 3. Thermal Engineering by R K Rajput, Laxmi. Publications
4	**Fluid mechanics and Pneumatics**	1. Bansal. R.K.,"*Fluid Mechanics and Hydraulics Machines",* 9th Edition, Laxmi Publications Private Limited, New Delhi. 2011. 2. R.S.Khurmi, *"Fluid Mechanics and Machinery",*S.Chand and Company, 2nd Edition, 2007. **3.** *Hydraulics & Pneumatics* – Andrew Parr, Jaico Publishing

		House New Delhi. **4.** *Hydraulic and Pneumatic Controls Understanding Made Easy-* K.S.Sundaram,-S.chand Company Delhi
5	**Management**	1. Industrial Organization and Engineering Economics T.R.Banga & S C Sharma 2. Khanna Publishers 3. Industrial management and organizational behavior K.K.Ahuja 4. Industrial management and engineering economics O.P.khanna Khanna publishers 5. Production and operations management -Dr .K.Aswathappa and Dr.Sreedhar Bhatt Himalaya publishers 6. Safety Management in Industry Krishnan.N V Jaico Publishing House, Bombay, 1997 7. Total Quality Management S Raja Ram, Shivashankar
6	**Material science and Measurements**	1. *Engineering Materials* by Er.R.K.RAJPUT of S.CHAND Publications *2. Mechanical Engineering Measurement* - Thomas Beckwith, N.Lewis Buck, Roy Marangoni - *Narosa Publishing House, Bombay* 3. *Mechanical Engineering Measurements* - A. K. Sawhney - *DhanpatRai& Sons, New Delhi.* 4. *"Engineering Metrology"* by R.K.Jain, Khanna Publishers, 1994