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SYLLABUS
M. TECH. ENTRANCE TEST-2021-22
MECHANICAL ENGINEERING DEPARTMENT
JAMIA MILLA ISLAMIA, NEW DELHI

Engineering Materials: Basic concepts of structure of solids, Crystalline materials, Defects in crystalline materials, Alloys and binary phase diagrams, Structure and properties of common engineering materials, Heat treatment of steels, Plastics, Ceramics and composite materials, Common applications of various materials.

Metal Casting: Design of patterns, Moulds and cores, Solidification and cooling, Riser and gating design, Design considerations.

Metal Forming: Plastic deformation and yield criteria, Fundamentals of hot and cold working processes, Load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes, Principles of powder metallurgy.

Joining and Welding: Solid State welding e.g. Friction welding, Friction stir welding, Resistance welding, Fusion Welding including electric arc welding ,Gas welding and Thermit welding, Brazing and soldering, Adhesive bonding.

Machining and Machine Tool Operations: Mechanics of machining, Single and multi-point cutting tools, Tool geometry and materials, Tool life and wear, Economics of machining, Principles of non-traditional machining processes such as EDM, ECM, PAM, EBM, LBM, AJM, USM etc.

Metrology and Inspection: Limits, Fits and tolerances, Linear and angular measurements, Comparators, Interferometry, Form and finish measurement, Alignment and testing methods, Tolerance analysis in manufacturing and assembly.

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools, Basic concepts of manufacturing cell, FMS and CIM.

Methods Study and Work Measurements: Time study, Motion study, Principles of motion economy, Flow process chart, Left-hand-right-hand chart, Man-machine chart, String diagram, Therbligs, Micro and memo motion studies, Work sampling, Method time measurement systems.

Production Planning and Control: Forecasting models, Aggregate production planning, Scheduling, Materials requirement planning, Supply chain management, Product design and development.

Inventory Control: Deterministic and probabilistic models, Safety stock inventory control systems.

Operations Research: Linear programming, Simplex method, Transportation, Assignment, Line balancing, Simple queuing models, CPM and PERT, Simulation.

Quality Control: Definition of quality, Quality control charts for variables and attributes, Sampling plans, OC curve, Total quality management, Quality function deployment.

Engineering Economy: Demand and supply, Determination of equivalent present worth, future worth and annual worth for discrete cash flows and discrete compounding, Nominal and effective interest rates, Breakeven analysis, Methods of depreciation calculations.

Ergonomics: Human-computer-interaction, Design of displays and controls, Industrial ergonomics.

Thermodynamics: Laws of thermodynamics, Entropy, Irreversibility and Availability, Behaviour of ideal and real gases, Calculation of work and heat in ideal processes, Analysis of thermodynamics cycles related to energy conversion.

I.C. Engines: Normal and abnormal combustion in SI and CI engines, Engine performance, Characteristics and its calculations, Fuel injection, Carburetion.

Energy Conversion Systems: Energy sources, Basic cycles related to energy conversion system, Rankine, Modified Rankine, Reheat, Regenerative cycles, Bratton cycle, Binary Vapour cycle, Combined cycle.

Fluid Mechanics: Fluid properties, Control-volume analysis of mass, momentum and energy, Equations of continuity, Bernoulli's equation, Boundary layer theory; Flow through pipes, Laminar and Turbulent Flow and Compressible flow.

Heat Transfer: Modes of heat transfer, One dimensional steady and unsteady heat conduction, Fins, Two dimensional steady state conduction, Free and forced convection from lat plate, Basics of heat transfer in condensation and pool boiling, Radiative heat transfer, black and grey surface shape factors, network analysis, Heat exchangers.

Refrigeration and air-conditioning: Refrigeration system, expansion devices, condensers and evaporators, Psychrometric chart, Vapour compression system, Vapour Absorption system, Humidification, Dehemidification, Adiabatic mixing, Solar refrigeration system, Properties of moist air, Psychometric chart, Cooling load calculation, Concepts of RSHF, GHSF, ESHF, Basics of air-conditioning equipment.

Steam and Gas Turbines: Impulse and reaction turbines, Pressure, Velocity compounding of turbine stages, Work done and power calculation.

Turbo Machines: Euler's equation, Classification and principles of operation of turbine, Pumps and compressors, Isothermal, adiabatic and polytropic compression, Intercooling and after cooling, minimum work requirement, Volumetric efficiency, Centrifugal and axial flow compressors, Tangential and reaction hydraulic turbines, Centrifugal pumps, Pelton, Francis, Kaplan and propekker turbines, Cavitation in pumps and turbines and its effects on performance.

Mechanical Measurements: Measurement of displacement, Velocity, Force, Torque, Strain, Speed, Temperature, Pressure, Vibration, Sound, Fluid flow measurement, Types of thermocouple and transducers.

Applied Mechanics: Equivalent force system and equilibrium, Structural mechanics, Friction, Centre of gravity and moment of inertia, Kinematics and kinetics of rigid bodies.

Theory of Machines: Kinematic and dynamic analysis of planer mechanisms, Cams, Gears and gear trains, Flywheels, Governors, Balancing of rigid rotors and field balancing, Balancing of single and multicylinder engines, Linear vibration analysis of mechanical systems, Critical speeds and whirling of shafts, Automatic controls.

Machine Design: Design procedure, Safety factor, Theories of failure, Design of Joints : Cotters, Keys, Splines, welded joints, threaded fasteners, joints formed by interference fits, Design of friction drives: couplings and clutches, belt and chain drives, power screws, Design of Power Transmission Systems: Gears and gear drives shaft and axle, Wire ropes, Design of Bearings: Hydrodynamics bearings and rolling element bearings.

Strength of Materials: Stress and strain in two and three dimensions, Principal stresses and strains, Mohr's construction, Linear elastic materials, Isotropy and anisotropy, Stress-strain relations, Uniaxial loading, Thermal stresses, Beams : Bending moment and shear force diagram, bending stresses and deflection of beams, Shear stress distribution, Torsion of shafts, Helical springs, Combined stresses, Thick-and thin-walled pressure vessels, Struts and columns, Strain energy concepts and theories of failure.