KAKATIYA UNIVERSITY, WARANGAL – 506009
Ph. D. Entrance Test in MECHANICAL ENGINEERING
SYLLABUS

APPLIED MECHANICS, STRENGTH OF MATERIALS AND MACHINE DESIGN

Engineering Mechanics: Free body diagrams and equilibrium; trusses and frames; virtual work; Kinematics and Dynamics of Particles and Rigid Bodies in plane motion, Impulse and momentum (linear and angular) and energy formulations; impact.

Strength of Materials : Stress and strain, stress – strain relationship and elastic constants, Mohr's circle for plane stress and plane strain, Thin cylinders; shear force and bending moment diagrams; Bending and shear stresses; Deflection of beams; torsion of circular shafts; Euler's theory of columns; strain energy methods; Thermal stresses, Testing of Materials with UTM, hardness and impact strength.

Machine Design: Design for static and dynamic loading ; Failure theories; Fatigue strength - S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints, shafts, spur gears, rolling and sliding contact bearing, brakes, clutches and springs.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; Dynamic analysis of slider-crank mechanism; Gear trains; flywheels. Gyroscope and Governors, Balancing of reciprocating and rotary masses. Vibrations: Free and Forced Vibration of Single Degree of Freedom Systems; Effect of Damping; Vibration Isolation; Resonance, Critical Speeds of Shafts.

FLUID MECHANICS AND THERMAL SCIENCES

Fluid Mechanics: Fluid properties; fluid statics, manometers, buoyancy; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; viscous flow of incompressible fluids; boundary layer; laminar and turbulent flow through pipes, head losses in pipes, bends ,hydraulic turbines and pumps.

Heat Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins; dimensionless parameters in free and forced convective heat transfer, various correlations, for heat transfer in flow over flat plates and through pipes; thermal boundary layer, effect of turbulence; radioactive heat transfer, black and grey surfaces, shape factors, network analysis; Heat exchanger performance, LMTD and NTU methods.

Thermodynamics: Zeroth, First and Second laws of thermodynamics; thermodynamics; thermodynamic system and process; Carnot cycle, irreversibility and availability; behavior of ideal and real gases, properties of pure substances, calculation of work and heat in ideal process; analysis of thermodynamic cycles related to energy conversion.

Applications: power Engineering: Steam tables, Rankine, Brayton cycles with regeneration and reheat I.C. Engines: air- standard Otto, Diesel cycles. two stroke and four stoke engines, combustion phenomenon. Steam power plant cycle , steam turbines, boilers.

Refrigeration and air–conditioning: Air compressor, Vapour refrigeration cycle, heat pumps, gas refrigeration, reverse Brayton cycle; moist air, psyehrometric chart, basic psychrometric processes.

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MATERIALS, MANUFACTURING AND INDUSTRIAL ENGINEERING

Engineering Materials: Structure and Properties of Engineering Materials, Heat Treatment, Stress-Strain Diagrams for Engineering Materials, Iron-carbon diagram.

Metal Casting: Design of Patterns, Moulds and Cores; Solidification and Cooling; Riser and Gating Design, Design Considerations, casting defects. 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 Process: Physics of Welding, Brazing and Soldering; Adhesive Bonding; Design Considerations in Welding.

Machining and Machine Tool Operations: Mechanics of Machining, Basic machine tool, Single and Multi-Point Cutting Tools, Tool Geometry and Materials, Tool Life and Wear; Economics of Machining; Principles of Non Traditional Machining Processes; Principles of Work Holding, Design Principles of Jigs and Fixtures

Metrology and Inspection: Limits, Fits and Tolerances; Linear and Angular Measurements; Comparators; Gauge Design; 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.

Production Planning and Control: Forecasting Models, Aggregate Production Planning, Scheduling, Materials Requirement Planning. Inventory Control: Deterministic Models; Safety Stock Inventory Control Systems.

Industrial Engineering: Introduction, breakeven analysis SQC, Job evaluation and merit rating. Inventory- Basic EOQ model, P&Q systems, analysis, ABC PERT / CPM models, simple queuing models.

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PH.D ENTRANCE EXAMINATION
MECHANICAL ENGINEERING
MODEL QUESTION PAPER

Time: 2 hours Max Marks:100

1 Which of the following statement is wrong?
   a. A flow whose streamline is represented by a curve, is called two dimensional flow.
   b. The total energy of a liquid particle is the sum of potential energy, kinetic energy and pressure energy.
   c. The length of divergent portion in a venturimeter is equal to the convergent portion.
   d. A pitot tube is used to measure the velocity of the flow at the required point in a pipe.

2. An electric cable of aluminium conductor (k=240W/mK) is to be insulated with rubber (k=0.15 W/mK).The cable is to be located in air(h=6 W/m^2K). The critical thickens of insulation will be
   a. 25mm b. 40mm c.160mm d. 800mm

3 A mass of 1 kg is attached to the end of a spring with a stiffness of 0.7 N/mm. The critical damping coefficient of this system is
   a.1.4 N-s/m b.18.52 N-s/m c.52.92 N-s/m d.529.2 N-s/m

4. A rod is enclosed centrally in a tube and the assembly is tightened by rigid washers. If the assembly is subjected to a compressive load, then
   a. rod is under compression
   b. tube is under compression
   c. both rod and tube are under compression
   d. tube is under tension and rod is under compression

5. The percentage of carbon is cast iron varies from
   a. 0.1 to 0.5 b. 0.5 to 1.0 c.1.0 to 1.7 d 2.1 to 4.5

6. If the cutting speed increase then the build up edge
   a. becomes longer
   b. may or may not form
   c. becomes smaller and finally doesn't form at all
   d. has nothing do with speed

7. In involute gears , the pressure angle is
   a. depends on the size of teeth
   b. depends on the size of the gear
   c. always constant
   d. Always variable

8. In inventory control theory ,the economic order quantity is
   a. average level of inventory
   b. optimum lot size
   c. capacity of a warehouse
   d. lot size corresponding to break-even analysis

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