Dr. Babasaheb Ambedkar Marathwada University Aurangabad
Syllabus for Ph.D. Entrance Test (PET) 2016
Under Faculty of Engineering & Technology
Subject: Mechanical Engineering

Section - A: Research Methodology

Unit-I

Objectives of Research, Research Approaches, Significance of Research, Types of Research, Research Process, Criteria of Good Research, Defining the Research Problem, Selecting the Problem, Technique Involved in Defining a Problem, Methods and Tools in Research, Qualitative and Quantitative Studies, Inquiry Forms, Questionnaire, Developing a Research Plan, Literature review, Use of Library, Books and Journals, Use of Internet (Different useful sites), Patent Search

Unit-II

Data analysis, Types of data, Parametric and Non-parametric Data, Basic Concepts of Probability, Probability Axioms, Analysis and Treatment of Data, Measures of Central Tendency, Measures of Dispersions, Measures of Symmetry, Measures of Peakedness.

Unit-III

Regression Analysis – Simple Linear Regression, Multiple linear Regression, Correlation and Regression Analysis, Tests of Hypothesis and Goodness of Fit: Definition of null and alternative hypothesis, students 't' distribution, Chi-square distribution, F-test

Unit-IV

Interpretation and Report Writing: Meaning of Interpretation, Techniques of Interpretation, Significance of Report Writing, Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Parts of Dissertation/Thesis writing, Different Styles of Dissertation/Thesis writing

Unit-V

Sources of procurement of Research Grants, Development of Research Proposal, Industry Institute Interaction, Writing a technical paper, Plagiarism and its Implications.

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Section - B: Mechanical Engineering

Unit-I: Applied Mechanics and Design

Engineering Mechanics: Free-body diagrams and equilibrium, trusses and frames, virtual work, kinematics and dynamics of particles and of rigid bodies in plane motion, impulse and momentum (linear and angular) and energy formulations, collisions.

Mechanics of Materials: Stress and strain, elastic constants, Poisson's ratio, 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, energy methods, thermal stresses, strain gauges and rosettes, testing of materials with universal testing machine, testing of hardness and impact strength.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms, dynamic analysis of linkages, cams, gears and gear trains, flywheels and governors, balancing of reciprocating and rotating masses, gyroscope.

Vibrations: Free and forced vibration of single degree of freedom systems, effect of Damping, vibration isolation, resonance, critical speeds of shafts.

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

Unit-II: Fluid Mechanics and Thermodynamics

Fluid Mechanics: Fluid properties, fluid statics, manometry, buoyancy, forces on submerged bodies, stability of floating bodies, control-volume analysis of mass, momentum and energy, fluid acceleration, differential equations of continuity and momentum, Bernoulli's equation, dimensional analysis, viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings.

Thermodynamics: Thermodynamic systems and processes, properties of pure substances, behaviour of ideal and real gases, zeroth and first laws of thermodynamics, calculation of work and heat in various processes, second law of thermodynamics, thermodynamic property charts and tables, availability and irreversibility, thermodynamic relations.

Applications: Power Engineering, Air and gas compressors, vapour and gas power cycles, concepts of regeneration and reheat. I.C. Engines Air-standard Otto, Diesel and dual cycles. Refrigeration and air-conditioning: Vapour and gas refrigeration and heat pump cycles, properties of moist air, psychrometric chart, basic psychrometric processes. Turbo machinery: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines.

Unit-III: Heat-Transfer

Heat-Transfer: Modes of heat transfer, one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins, unsteady heat conduction, lumped parameter system, Heisler's charts, thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence, heat exchanger performance, LMTD and NTU methods, radiative heat transfer, Stefan-Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis.

Unit-IV: Engineering Materials, Manufacturing Technology

Engineering Materials: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials. Casting, Forming and Joining Processes: Different types of castings, design of patterns, moulds and cores, solidification and cooling, riser and gating design. 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. Principles of welding, brazing, soldering and adhesive bonding.

Machining and Machine Tool Operations: Mechanics of machining, basic machine tools, 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 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.

Unit- V: Production, Industrial Engineering And CAD/ CAM/CAE

System design: factory location plant layout methods based, applications of engineering economic analysis and break - even analysis for product selection, process selection and capacity planning, predetermined time standards. System planning, forecasting methods based on regression and decomposition, design and balancing of multi model and stochastic assembly lines , inventory management probabilistic inventory models for order time and order quantity determination, JIT systems, strategic sourcing, managing inter plant logistics.
System operations and control: Scheduling algorithms for job shops, applications of statistical methods for product and process quality control -applications of control charts for mean, range, percent defective, number of defectives and defects per unit, quality cost systems, management of resources, organizations and risks in projects. System improvement: Implementation of systems, such as total quality management, developing and managing flexible, lean and agile organizations. Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning. Inventory Control: Deterministic models, safety stock inventory control systems. Operations Research: Linear programming, simplex method, transportation,
assignment, network flow models, simple queuing models, PERT and CPM.
Computer Integrated Manufacturing, CAPP, FMS, Basic concepts of CAD/CAM and CAE