

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

PROPOSED SYLLABUS FOR Ph. D. ENTRANCE TEST

FACULTY OF MECHANICAL / PRODUCTION ENGINEERING

Section -A: Common paper for ALL candidates

Research Methodology

Section B:

Applied Mechanics and Design

Engineering Mechanics:Free body diagrams and equilibrium, kinematics and dynamics of particles and rigid bodies in plane motion; impact.

Mechanics Of Solids: Stress and strain, force and bending moment diagram, bending and shear stresses, deflection of beams , torsion of circular shafts, springs ,thin walled section, Euler's theory of columns, strain energy methods, thermal stresses, mechanical properties, material testing.

Theory Of Machines: Kinematics and dynamics of plane mechanism , dynamic analysis of slider crank mechanism, gear trains, fly wheels, bearings , governors, static and dynamic balancing of rotors.

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

Design: Design for static and dynamic loading, failure theories, principles of the design of machine elements such as shafts, spur gears, rolling and sliding contact bearings, brakes, clutches and various joints.

Production and Industrial Engineering

Production Engineering: Unconventional Machining Processes, Computer controlled machines, CAD/CAM, CNC, Mechanics of Metal Cutting, Tool wear and Machinability, Economics of Metal Cutting, Metal Forming and Casting Processes, Advanced Manufacturing processes, Powder Metallurgy, Joining Processes, Super Finishing Processes, Non Traditional Machining Processes.

Industrial Engineering: Production systems, System approach, Productivity, Product design and development, Production Planning and Control, Statistical Quality Control, Operations Scheduling, Linear Optimization Models, Assignment and transportation models. Waiting line models, capacity

planning, plant and facility lay out, plant location. Production and Assembly Line Balancing, Time and Motion Study, Work sampling, Predetermined Time Systems, Principle of motion economy, Industrial Safety, Cost concepts and Break Even analysis, Interest and Money time relationships, Demand and Supply relationships, Market types and competition, Principles of management, Motivation, Organization, Forecasting.

Thermal Engineering

Thermodynamics: Basic laws of Thermodynamics, Availability, Irreversibility, Ideal Gases. Concept of Energy, Energy Sources, Thermodynamic cycles related to energy conversion.

Heat Transfer: Basic modes of Heat Transfer, Heat Exchangers, Laws of Conduction, Convection and Radiation.

I.C.Engines: Basic working principle of 2 stroke, 4 stroke Petrol and Diesel engine. Air standard cycles, normal and abnormal combustion in S.I. Engines and C.I. engines. Engine performance, alternative fuel for I.C. engines.

Fluid Mechanics And Machines: Fluid properties, Bernoullis equation, flow through pipes and hydraulic machines..

Turbo Machines: Euler's equation, fans, compressors and pumps, turbines

Refrigeration and Air conditioning: Refrigeration systems, vapour compression cycles, vapour absorption system, air compression cycles. Refrigerants, Expansion devices, condenser and evaporator, psychometry.

Gas Dynamics: Basic equations for fluid flow, wave propagation, reyleigh line, fanno line, shock waves.

Group I : MACHINE DESIGN

Mechanical Engineering Design: Load analysis, modes of failure, theories of failure, safety factors, reliability, selection of materials and design of machine elements subjected to static and fatigue loading, shafts, gears, bearings, etc. Design against creep and fracture, Tribological system design.

Theoretical and Experimental Stress Analysis: Analysis of three dimensional state of stress and strain, experimental stress analysis tools like photo elasticity, strain rosetts, brittle coating, Moire fringes.

Mechanisms: Kinematic and dynamic analysis and synthesis of planar and spatial mechanisms, Euler Savary equation, cubic of stationary curvature, numerical methods in kinematics and dynamics.

Vibrations: Free, Damped and Forced vibrations of Single degree, multi degree and continuous mechanical systems, vibration measuring instruments, vibration isolation, numerical methods, transient and non linear vibrations.

OR

Group II : PRODUCTION AND INDUSTRIAL ENGINEERING

Production Engineering: Mechanical behavior of metals, advanced casting processes, advanced finishing processes. Theories of fracture, creep and fatigue, Smart materials, advanced manufacturing processes, Non conventional machining processes, fundamentals of automated production, flexibility, computer controlled machines, computer aided process planning, Computer Integrated manufacturing, Flexible manufacturing systems.

Industrial Engineering: Statistical process control, TQM, Enterprise resource planning, supply chain management, inventory control, MRP, business process redesign, value engineering, materials handling, environmental issues and green practices, technology management, reliability, experimental design, statistical tools and applications, project management, dynamic programming and nonlinear programming, game theory, decision tree, Monte Carlo simulation, Ergonomics.

OR

GROUP III: MANUFACTURING PROCESS ENGINEERING:

Advanced Manufacturing Techniques: Process Principle, parameters, applications and special feature of AFM, ECD, ECG, WJM, MAF, Chemical machining, Automation of NCMPs., PVD, CVD, Electro less technology, Plasma Spraying,. Plasma coating of ceramic powders and polymeric powders, Coating tribology, investment Casting, shell mould Casting , Full mould Casting , Continuous Casting and shape Casting, Heat Flow analysis in Continuous and shape Casting. Casting defects and remedies, inspection of Casting, Solidification Process in casting.

Computer Aided Manufacturing: Productivity Vs Flexibility, Hard and Soft automation. Basic ideas in NC, CNC, DNC and Machining Center, FMS, QFD, DFM, QLF of Taguchi. Process Capability, Process Capability Index, GT for Concurrent Engineering, Basic machining Calculations, Process optimization, online process performance monitoring and inspection.

Robotics and Robot Applications: Manipulation and performance of robot, end-effectors, kinematics of robot, programming and robot languages VAL, VAL-PLUS, VAL II, ARL HARL, AL, PLAW, IRL, robot application in manufacturing. Stepper motor drive-construction, working step angle, stepping rate torque dynamic détente torque, switching scheme wave and phase techniques

OR

GROUP-IV: THERMAL ENGINEERING

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.

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

Turbo Machines: Euler's equation, Reciprocating air compressors, Compression of gases, Intercooling and aftercooling, minimum work requirement, Centrifugal and axial flow compressors. Hydraulic Turbines, Centrifugal pumps.

Heat-Transfer: Modes of heat transfer, Resistance concept, Unsteady heat conduction, Fins, Effect of turbulence, Radiative heat transfer, black and grey surfaces shape factors, network analysis, Heat exchangers.

I.C. Engines: Requirements and suitability of fuels in IC engines, Normal and abnormal combustion in SI and CI engines, Engine performance calculations, Turbocharging, Supercharging, Pollutant formation and control methods, Emission norms, Stratified charge engines, Homogenous charge compression ignition (HCCI) engines, Zero emission vehicles.

Refrigeration and air-conditioning: Refrigeration system, expansion devices, condensers and evaporators, Psychrometric chart, Vapor Absorption system, Humidification, Dehumidification, Adiabatic mixing, Multistage multi evaporation system, Three fluid absorption system, Solar refrigeration system.

Energy Conversion System: Basic cycles related to energy conversion systems, Combined cycle, Cogeneration system, Steam generator, Steam turbine, Gas turbines, Nuclear power plant, Hydroelectric plant.

Non-Conventional Energy Sources: Solar energy system, Solar power plant, Wind, Tidal, Wave and Geothermal energy, Energy from Biomass and Biofuels.

Gas Dynamics: Basic equations of fluid flow, Wave propagation, Shock waves, Expansion waves, Rayleigh line, Fanno line, Rarefied Gas Dynamics, Measurement in compressible flow.