

**SYLLABUS**  
**PH.D. ENTRANCE TEST-2012-13**  
**MECHANICAL ENGINEERING DEPARTMENT**  
**JAMIA MILLA ISLAMIA, NEW DELHI**

**NOTE: This syllabus consists of the following TWO parts:**

- 1. PART B1 is objective type which carries 50 marks and it is common to all THREE stream i.e. Machine Design, Production and Industrial Engineering and Thermal Engineering.**
- 2. PART B2 is subjective type which also carries 50 marks and it is only for specific stream i.e. Machine Design, Production and Industrial Engineering and Thermal Engineering.**

**PART B1: COMMON PAPER**

**Applied Mechanics and Design**

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

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

**Theory of Machines:** Kinematics and dynamics of plane mechanisms; dynamic analysis of slider-crank mechanism; gear trains; flywheels; bearings; governors; static & dynamic balancing of rotors.

**Vibrations:** 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, Casting Processes, Powder Metallurgy, Joining Processes, Finishing operations and super finishing processes, Measurement.

**Industrial Engineering:** Production systems, Systems approach, Productivity, Product design and development, Production Planning and Control, Statistical Quality Control, Operations Scheduling, Linear Optimization Models, Assignment and Transportation Models, Waiting Line Mechanical Engineering Department

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**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.