DEPARTMENT OF MECHANICAL ENGINEERING

The following broad areas/specializations of research are as follows:

1.Fluid Mechanics and Machinery
2. Solar Energy
3.Thermal Engineering
4. Applied Mechanics and Machine Design

Syllabus for Subject Specific Test

1. Fluid Mechanics and Machinery

Basic concepts of fluid statics: Concept of continuum and physical properties of fluids, specific gravity, viscosity surface Tension, vapor pressure. Measurement of pressure- Piezometer, U-tube and differential tube manometers.

Fluid kinematics: Eulerian and Lagrangian description of fluid flow, Stream line, path line and streak lines and stream tube, classification of flows-steady and unsteady, uniform, non-uniform, laminar, turbulent, rotational, and irrotational flows, equation of continuity for one dimensional flow. Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend, Boundary layer theory.

Turbo machinery: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory, functions and efficiency. Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer, Centrifugal pumps: Classification, working, work done, manomertic head, losses and efficiencies.

Basic concepts of compressible flow, normal and oblique shocks, Rayleigh and Fnno flows.

2. Solar Energy

Solar photovoltaic-single crystalline, polycrystalline, amorphous, Solar collector: Importance, type, performance indices; Solar air heater: Classification, single pass air heater, double pass air heater; Solar Water Heater: Passive mode (pressured and no pressurised), active mode; Solar Passive Space-Heating and Cooling: Importance, Trombe wall; Solar Refrigeration and Air-Conditioning System: Importance, Classification, coefficient of performance, Solar Cooker: Importance, advantages, box type solar cooker, dish-type solar cooker, community solar cooker, advance solar cooker; Solar Furnace: Importance, components, advantages, disadvantages; Solar Greenhouse: Importance, components, advantages, disadvantages; Solar Dryer: Direct solar dryer, indirect solar dryer, mixed mode solar dryer; Solar Desalination: solar desalination under active mode, solar desalination under passive mode.

3. Thermal Engineering

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, dimensionless parameters in free and forced convective heat transfer, various correlations for heat transfer in flow over flat plates and through pipes; heat exchanger performance, LMTD and NTU methods.
Thermodynamics: Zeroth, First, Second and Third laws of thermodynamics; thermodynamic system and processes; Carnot cycle. irreversibility and availability; I.C. Engines: air-standard Otto, Diesel cycles. Refrigeration and air-conditioning: Vapour refrigeration cycle.

4. Applied Mechanics and Machine 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, including 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.

Mechanical 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, spur gears, rolling and sliding contact bearings, brakes and clutches.