

## **Syllabus for Ph.D. (Energy Science and Engineering) Entrance Examination**

### **General Mechanical System**

Fluid properties, mass, momentum and energy equation, modes of heat transfer; conduction, convection and radiation, dimensionless parameters, Thermodynamics; system and process, laws of thermodynamics, availability and irreversibility, I.C. engines, Refrigeration and Air Conditioning.

### **Energy Systems**

Conventional power generation systems, Renewable energy systems; Solar Energy: solar photovoltaic and thermal systems, Wind: current status, types, measuring instruments, potential assessment, Biomass: gasification, anaerobic and aerobic decomposition, fermentation and incineration and Energy from waste.

### **Energy Conservation and Audit**

Energy Audit, types of energy audit; Energy Audit approach: optimizing the input energy requirement; Energy audit instruments. Energy Management: Concept of energy management, energy demand and supply, economic analysis; Duties and responsibilities of energy managers, Energy conservation Act. Energy Conservation: Basic concept, energy conservation in Household, Transportation, Agricultural, service and Industrial sectors, Lighting, Heating Ventilation & Air Conditioning. Tariffs and Power factor improvement in power system, Demand Side management concept, Energy Efficient Practices and Technologies.

### **Energy Storage Technology**

Different modes of energy storage, Technology Types– Mechanical energy storage: flywheels, compressed air, and pumped hydro; Electrical and Magnetic Energy storage: Batteries, Capacitors, electromagnets, Chemical energy storage.

### **Building and Energy**

Need of energy in buildings. Role of building design and building services to evaluate the energy performance in buildings. Study of Climate and its influence in building design for energy requirement, Principles of energy conscious design of buildings, Building Envelope, Orientation, Building Configuration, Passive Cooling, Basic Principles of Day-lighting

### **Ecology, Environment & Climate Change**

Earth's temperature and atmosphere, nature of Sun radiations, Biological processes, Food chains, Ecological Cycles, Bio Diversity, Environmental degradation, pollutants, Thermal and radioactive pollution, air and water pollution, Climate Change global protocols

### **Energy Efficient Machines**

Transformers, auto-transformer; DC machines, induction motors; synchronous machines – performance, regulation and parallel operation of generators, motor starting, characteristics and applications

### **Grid Connected Energy Systems**

Power generation transmission distribution systems concepts; power factor correction; economic operation; fault analysis. Principles of over-current, differential and distance protection; solid state relays and circuit breakers

### **Power Conversion Methods & Devices**

A/D and D/A converters; Power diodes, transistors, thyristors, MOSFETs and IGBTs – triggering circuits; phase control rectifiers; bridge converters, principles of choppers and inverters; basic concepts of dc and ac drives, basics of 8-bit microprocessors