

Syllabus for PhD Admission Test Under Centre for Energy and Environment

I. General Aptitude (GA)

- Verbal Aptitude

Basic English grammar: tenses, articles, adjectives, prepositions, conjunctions, verb-noun agreement, and other, parts of speech, Basic vocabulary: words, idioms, and phrases in context, Reading and comprehension, Narrative sequencing, verbal analogies, word groups, instructions, critical reasoning and verbal deduction

- Quantitative Aptitude

Data interpretation: data graphs (bar graphs, pie charts, and other graphs representing data), 2- and 3-dimensional, plots, maps, and tables, Numerical computation and estimation: ratios, percentages, powers, exponents and logarithms, permutations and combinations, and series, Mensuration and geometry, Elementary statistics and probability, numerical reasoning and data interpretation

- Research Methodology

Foundations of Research, Concept of theory, deductive and inductive theory, Research Process, Problem Identification, Research Question, Hypothesis, Null Hypothesis & Alternative Hypothesis, Research design, Experimental Design, Qualitative and Quantitative Research, Levels of measurement, Sampling, ANOVA, Data Preparation, Interpretation of Data and Paper Writing, Layout of a Research Paper, Impact factor of Journals, Tools / techniques for Research, intellectual property rights, plagiarism, Research honesty and integrity, authorship, acknowledgement and citation, funding agencies and sponsorship

II. Course Related

- Fundamental of Energy Technology.

Relevant principles of heat transfer, combustion, fluid mechanics, power systems, power grid, power plants, materials, etc.

- Renewable Sources of Energy.

Solar Radiation, Solar Thermal Energy collection - Flat Plate and focusing collectors their materials and performance. Solar Thermal Energy Storage, Applications – heating, cooling and Power Generation; Solar Photovoltaic Conversion; Harnessing of Wind Energy, Bio-mass and Tidal Energy – Methods and Applications, Working principles of Fuel Cells.

- Scope of Renewable Energy and Resource Assessment

Solar Energy, Wind Energy, Geothermal, Bioenergy, Hybrid systems, Energy planning, Economics, Potential, Assessment etc.

- Power Systems.

Fuels and their properties, Boilers, Steam turbines and other power plant components like condensers, air ejectors, electrostatic precipitators and cooling towers - types and applications, Power factor correction, Circuit breakers, Solar and wind power, environmental implications, Transistors, Thyristors, DC-DC switched mode converters, DC-AC switched mode converters, resonant converters, high frequency inductors and transformers, power supplies.

- Engineering Materials.

Alloys and phase diagrams, Ceramic, Magnetic and Insulating materials- properties and applications, Ferrous and Non Ferrous Metals, Non metallic materials, Nano-materials, Mechanical Properties and Testing, Corrosion prevention and control

- Machines

Shafts, Gears, Slider, Gyroscopes, Ships and aircrafts, Governors, Single phase transformers, three phase transformers, DC machines - types, windings, generator characteristics, Induction motors - principles, types, performance characteristics, Synchronous machines, Generators, Motor starting, characteristics and applications, servo and stepper motors.

- Control Systems

Ideal voltage and current sources, dependent sources, Basic concepts of electrical power generation, ac and dc transmission concepts, Models and performance of transmission lines and cables, Series and shunt compensation, Electric field distribution and insulators, P, PI and PID controllers; State space model, Solution of state equations of LTI systems, R.M.S. value

- Heat Transfer

Steady and unsteady heat conduction, convection and radiation, thermal boundary layer and heat transfer coefficients, boiling, condensation and evaporation; types of heat exchangers and evaporators and their process calculations, Design of double pipe, shell and tube heat exchangers, and single and multiple effect evaporators.

- Energy and Environment

Energy impact on environment, Climate change, pollution, Carbon emissions etc., energy planning, economics, assessment, potential etc., Current status of Govt policies on Renewable Energy, India's target in energy sector