BROAD CONTENTS OF THE GENERAL STUDIES AND ENGINEERING APTITUDE PAPER (Stage-I, Paper-I).

General Studies and Engineering Aptitude

(Stage I - Paper I, Objective type, Common to all Candidates, 2 hours duration, 200 Marks maximum)

The questions from the following Topics will be set in Paper-I of Stage-I.

1. Current issues of national and international importance relating to social, economic and industrial development.

2. Engineering Aptitude covering Logical reasoning and Analytical ability

3. Engineering Mathematics and Numerical Analysis 4. General Principles of Design, Drawing, Importance of Safety

5. Standards and Quality practices in production, construction, maintenance and services

6. Basics of Energy and Environment: Conservation, environmental pollution and degradation, Climate Change, Environmental impact assessment

7. Basics of Project Management

8. Basics of Material Science and Engineering

9. Information and Communication Technologies (ICT) based tools and their applications in Engineering such as networking, e-governance and technology based education.

10. Ethics and values in engineering profession

Note:

The paper in General Studies and Engineering Aptitude will include Knowledge of relevant topics as may be expected from an engineering graduate, without special study.

Questions from all the 10 topics mentioned above shall be set. Marks for each Topic may range from 5% to 15% of the total marks in the paper.

UNION PUBLIC SERVICE COMMISSION, NEW DELHI ENGINEERING SERVICES EXAMINATION (ESE) SYLLABI

Branch/Discipline: Electrical Engineering

Contents for syllabi of both the Papers together for Stage-I objective type Paper-II and separately for Stage-11 Conventional type Paper-I and Paper - II

Paper-I

1. Engineering Mathematics:

Matrix theory, Eigen values & Eigen vectors, system of linear equations, Numerical methods for solution of non-linear algebraic equations and differential equations, integral calculus, partial derivatives, maxima and minima, Line, Surface and Volume Integrals. Fourier series, linear, non-linear and partial differential equations, initial and boundary value problems, complex variables, Taylor's and Laurent's series, residue theorem, probability and statistics fundamentals, Sampling theorem, random variables, Normal and Poisson distributions, correlation and regression analysis.

2. Electrical Materials:

Electrical Engineering Materials, crystal structures and defects, ceramic materials, insulating materials, magnetic materials — basics, properties and applications; ferrities, ferro-magnetic materials and components; basics of solid state physics, conductors; Photo-conductivity; Basics of Nano materials and Superconductors.

3. Electric Circuits and Fields :

Circuit elements, network graph, KCL, KVL, Node and Mesh analysis, ideal current and voltage sources, Thevenin's, Norton's, Superposition and Maximum Power Transfer theorems, transient response of DC and AC networks, Sinusoidal steady state analysis, basic filter concepts, two-port networks, three phase circuits, Magnetically coupled circuits, Gauss Theorem, electric field and potential due to point, line, plane and spherical charge distributions, Ampere's and Biot-Savart's laws; inductance, dielectrics, capacitance; Maxwell's equations.

4. Electrical and Electronic Measurements:

Principles of measurement, accuracy, precision and standards; Bridges and potentiometers; moving coil, moving iron, dynamometer and induction type instruments, measurement of voltage, current, power, energy and power factor, instrument transformers, digital voltmeters and multi-meters, phase, time and frequency measurement, Q-meters, oscilloscopes, potentiometric recorders, error analysis, Basics of sensors, Transducers, basics of data acquisition systems

5. Computer Fundamentals:

Number systems, Boolean algebra, arithmetic functions, Basic Architecture, Central Processing Unit, I/O and Memory Organization; peripheral devices, data representation and programming, basics of Operating system and networking, virtual memory, file systems; Elements of programming languages, typical examples.

6. Basic Electronics Engineering:

Basics of Semiconductor diodes and transistors and characteristics, Junction and field effect transistors (BJT, FET and MOSFETS), different types of transistor amplifiers, equivalent circuits and frequency response; oscillators and other circuits, feedback amplifiers.

PAPER — II

1. Analog and Digital Electronics:

Operational amplifiers — characteristics and applications, combinational and sequential logic circuits, multiplexers, multi-vibrators, sample and hold circuits, A/D and D/A converters, basics of filter circuits and applications, simple active filters; Microprocessor basics- interfaces and applications, basics of linear integrated circuits; Analog communication basics, Modulation and de-modulation, noise and bandwidth, transmitters and receivers, signal to noise ratio, digital communication basics, sampling, quantizing, coding, frequency and time domain multiplexing, power line carrier communication systems.

2. Systems and Signal Processing:

Representation of continuous and discrete-time signals, shifting and scaling operations, linear, time-invariant and causal systems, Fourier series representation of continuous periodic signals, sampling theorem, Fourier and Laplace transforms, Z transforms, Discrete Fourier transform, FFT, linear convolution, discrete cosine transform, FIR filter, IIR filter, bilinear transformation.

3. Control Systems:

Principles of feedback, transfer function, block diagrams and signal flow graphs, steady-state errors, transforms and their applications; Routh-hurwitz criterion, Nyquist techniques, Bode plots, root loci, lag, lead and lead-lag compensation, stability analysis, transient and frequency response analysis, state space model, state transition matrix, controllability and observability, linear state variable feedback, PID and industrial controllers.

4. Electrical Machines:

Single phase transformers, three phase transformers - connections, parallel operation, auto-transformer, energy conversion principles, DC machines -types, windings, generator characteristics, armature reaction and commutation, starting and speed control of motors, Induction motors - principles, types, performance characteristics, starting and speed control, Synchronous machines - performance, regulation, parallel operation of generators, motor starting, characteristics and applications, servo and stepper motors.

5. Power Systems:

Basic power generation concepts, steam, gas and water turbines, transmission line models and performance, cable performance, insulation, corona and radio interference, power factor correction, symmetrical components, fault analysis, principles of protection systems, basics of solid state relays and digital protection; Circuit breakers, Radial and ring-main distribution systems, Matrix representation of power systems, load flow analysis, voltage control and economic operation, System stability concepts, Swing curves and equal area criterion. HVDC transmission and FACTS concepts, Concepts of power system dynamics, distributed generation, solar and wind power, smart grid concepts, environmental implications, fundamentals of power economics.

6. Power Electronics and Drives:

Semiconductor power diodes, transistors, thyristors, triacs, GTOs, MOSFETs and IGBTs - static characteristics and principles of operation, triggering circuits, phase control rectifiers, bridge converters - fully controlled and half controlled, principles of choppers and inverters, basis concepts of adjustable speed dc and ac drives, DC-DC switched mode converters, DC-AC switched mode converters, resonant converters, high frequency inductors and transformers, power supplies.