

Syllabus for Tier-I & Tier – II of Combined Examination for the Post of Assistant Engineer (Electrical)

GENERAL TOPICS

Section – A of Tier-I Examination

- (i) **General Awareness:** Questions will be designed to test the ability of the candidate's General Awareness of the environment around him/her and its application to society. The questions will be designed to test knowledge of Current Events and of such matter of everyday observation as may be expected of an educated person. The test will also include questions relating to History, Polity, Constitution, Sports, Art & Culture, Geography, Economics, Everyday Science, Scientific Research, National/International Organizations /Institutions etc.
- (ii) **General Intelligence & Reasoning Ability:** The syllabus of General Intelligence & Reasoning Ability includes questions of both verbal and non-verbal types. Test may include questions on analogies, similarities, differences, space visualization, problem solving, analysis, judgment, decision making, visual memory, discrimination, observation, relationship, concepts, arithmetical reasoning, verbal and figure classification, arithmetical number series etc.
- (iii) **Arithmetical & Numerical Ability :** The test of Arithmetical and Numerical Abilities will cover Number Systems including questions on Simplification, Decimals, Data Interpretation, Fractions, L.C.M., H.C.F., Ratio & Proportion, Percentage, Average, Profit & Loss, Discount, Simple & Compound Interest, Mensuration, Time & Work, Time & Distance, Tables & Graphs etc.
- (iv) **Hindi Language & Comprehension:** Testing of candidate's understanding and comprehension of the Hindi Language. In addition to this, questions on its Vocabulary, Grammar, Sentence Structure, Synonyms, Antonyms and its correct usage etc. would also be covered.
- (v) **English Language & Comprehension:** Testing of candidate's understanding and comprehension of the English Language. In addition to this, questions on its Vocabulary, Grammar, Sentence Structure, Synonyms, Antonyms and its correct usage etc. would also be covered.

SUBJECT SPECIFIC TOPICS : Electrical Engineering

Section – B of Tier-I and Part – I and Part – II of Tier – II of Examination

Mathematics

- ❖ Calculus
- ❖ Sequences and Series
- ❖ Multivariable Calculus: Differentiation
- ❖ Multivariable Calculus: Integration
- ❖ First Order Ordinary Differential Equations
- ❖ Ordinary Differential Equations of Higher Order
- ❖ Solid Geometry & Multiple Integrals
- ❖ Ordinary & Partial Differential Equations
- ❖ Complex Analysis
- ❖ Matrices

Physics

- ❖ Physics of Motion
- ❖ Waves
- ❖ Non-dispersive transverse and longitudinal waves
- ❖ Light and Optics
- ❖ Electromagnetism
- ❖ Physics of Materials
- ❖ Lasers
- ❖ Relativity & Quantum Theory
- ❖ Introduction to Quantum Mechanics

Chemistry

- ❖ Atomic and molecular structure
- ❖ Spectroscopic techniques and applications
- ❖ Intermolecular forces and potential energy surfaces
- ❖ Use of free energy in chemical equilibrium
- ❖ Periodic properties
- ❖ Inorganic chemistry
- ❖ Organic reactions and synthesis of a drug molecule
- ❖ Polymers
- ❖ Nonmaterial and Composites

Basics Of Electrical Engineering

- ❖ Fundamentals of electric circuits, Kirchhoff's laws, mesh analysis, node analysis, classification of network elements, Thevenin's theorem, Norton's theorem maximum power transfer theorem, superposition theorem.

- ❖ Single phase AC circuits, average and effective values of sinusoids, solution of R,L,C series circuits, the j operator, complex representation of impedances, phasor diagram, concept of power factor, power factor improvement, power in complex notation, solution of parallel and series-parallel circuits, resonance. Introduction to balance three phase AC circuits.
- ❖ Ampere's circuital law, B-H curve, solution of magnetic circuits, hysteresis and eddy current losses. Relays as an application of magnetic force. Transformers- construction, e.m.f. equation, ratings, phasor diagram for no load and full load, equivalent circuit, regulation and efficiency calculations, open circuit and short circuit tests, Introduction to Auto-Transformer.
- ❖ Introduction to Electromechanical Energy Conversion, DC motors- construction, e.m.f. and torque equations, characteristics of DC generators and motors, speed control of DC motors. DC motor starter- working principle, ratings. Introduction to three phase induction motor, Introduction to alternator and synchronous motor and their applications.
- ❖ PMMC instruments, shunts and multipliers, multi-meters, moving iron ammeters and voltmeters, dynamometer wattmeter, AC watt-hour meters, extension of instrument ranges.

Facets of Electrical Engineering

- ❖ DC Circuits
- ❖ AC Circuits
- ❖ Transformers
- ❖ Electrical Machines
- ❖ Power Converters
- ❖ Electrical Installations

Engineering Mechanics

- ❖ Introduction to vectors and tensors and co-ordinate systems
- ❖ Three-dimensional Rotation
- ❖ Kinetics of Rigid Bodies
- ❖ General Motion
- ❖ Bending Moment

Electrical Circuit Analysis

- ❖ Network Theorems
- ❖ Solution of First and Second order networks
- ❖ Sinusoidal steady state analysis
- ❖ Two Port Network and Network Functions

Analog Electronic Circuits

- ❖ Diode circuits
- ❖ BJT circuits
- ❖ MOSFET circuits

- ❖ **Linear applications of op-amp**

Electrical Machines

- ❖ **Magnetic fields and magnetic circuits**
- ❖ **Electromagnetic force and torque**
- ❖ **DC machines**
- ❖ **Transformers**
- ❖ **Fundamentals of AC machine windings**
- ❖ **Induction Machines**
- ❖ **Synchronous machines**

Digital Electronics

- ❖ **Fundamentals of Digital Systems and logic families**
- ❖ **Sequential circuits and systems**
- ❖ **Semiconductor memories and Programmable logic devices**

Signals and Systems

- ❖ **Introduction to Signals and Systems**
- ❖ **Sampling and Reconstruction**

Control Systems

- ❖ **Introduction to control problem**
- ❖ **Introduction to Controller Design**
- ❖ **State variable Analysis**

Microprocessors

- ❖ **Fundamentals of Microprocessors**
- ❖ **Instruction Set and Programming**
- ❖ **Memory and I/O Interfacing**

Line-Commutated and Active PWM Rectifiers

- ❖ **Diode rectifiers with passive filtering**
- ❖ **Multi-Pulse converter**
- ❖ **AC-DC bidirectional boost converter**

Electrical Drives

- ❖ **DC motor characteristics**
- ❖ **Multi-quadrant DC drive**
- ❖ **Induction motor characteristics**
- ❖ **Scalar control or constant V/f control of induction motor**

Electrical and Hybrid Vehicles

- ❖ **Introduction**
- ❖ **Electric Trains**
- ❖ **Energy Management Strategies**

Power System Protection

- ❖ Introduction and Components of a Protection System
- ❖ Fault and Over-Current Protection
Equipment Protection Schemes
- ❖ System Protection

Power Quality and FACTS

- ❖ Transmission Lines and Series/Shunt Reactive Power Compensation
- ❖ Voltage Source Converter based (FACTS) controllers
- ❖ Application of FACTS

Electrical Energy Conservation and Auditing

- ❖ Energy Scenario
- ❖ Basics of Energy and its various forms
- ❖ Energy Management & Audit
- ❖ Energy Efficiency in Industrial Systems

Power System Dynamics and Control

- ❖ Introduction to Power System Operations
- ❖ Modeling of Synchronous Machines and Associated Controllers
- ❖ Stability Analysis
- ❖ Enhancing System Stability

Digital Signal Processing

- ❖ Discrete-time signals and systems
- ❖ Z-transform
- ❖ Design of Digital filters
- ❖ Applications of Digital Signal Processing

Computer Architecture

- ❖ Introduction to computer organization
- ❖ Memory organization
- ❖ Input – output Organization
- ❖ Pipelining