

**Competitive Examination Scheme & Syllabus for Assistant Engineer (Electrical) - Grade II,
Maharashtra Engineering Services, Group-B**

Stages of Examination

1. Preliminary Examination - 150 Marks
2. Main Examination - 600 Marks
3. Interview - 100 Marks

Detail syllabus of Preliminary Examination is as follows

1. Preliminary Examination : English and General Studies

Standard : Degree Level

Total Marks : 150

Medium : English

Nature of Paper : Objective Type

Duration : 1 ½ Hours

ENGLISH (50 Marks)

Common Vocabulary , Sentence structure , Grammar, Comprehension of passage.

GENERAL STUDIES (25 Marks)

Part – I

- 1) History of Modern India (special reference to Maharashtra)
- 2) Geography of India (special reference to Maharashtra)
- 3) Indian Political System (with reference to Indian Constitution), Administration of State and Local Self – Government (Rural and Urban)

Part – II

GENERAL STUDIES RELATED TO ELECTRICAL ENGINEERING (75 Marks)

Fundamentals of electrical engineering, DC and AC network theorems, Behavior of R-L, R-C and R-L-C circuits, Basics of Electromagnetism and electrostatics, Three phase circuits, power and energy in single phase and three phase circuits, Measurement of electrical parameters for sinusoidal and non sinusoidal systems. Single phase and three phase transformers, Distribution and Power Transformers, Instrument transformers, Basics of energy conversion, Construction, Working, Performance of DC machine, Induction machine and Synchronous machine. Parallel operation of transformers and Alternators, Power Generation scenario of the country and Maharashtra, P.U.Systems, Symmetrical and asymmetrical fault calculations, Selection of switchgear and protection devices, Relaying and coordination, Substation components, Earthing, grounding and lightning protection, AC-DC, DC-AC power converters, Power Quality issues, Reactive power compensation, Fundamentals of AC and DC drives, Energy saving using VSD's, Type and routine tests, field tests for electrical equipment such as transformers, motors, switchgear, insulators, cables, batteries etc and the relevant Indian Standards. Codes of electrification of buildings, DG, UPS selection, Basics of illumination systems, types of bulbs, lamps, etc. Non conventional energy sources, Economics of solar-thermal, solar-electrical systems, Energy conservation opportunities in fans, pumps, compressors, HVAC etc. Codes for electrical safety, and Fire fighting equipment and systems.

2. Main Examination- Main Examination consists of 3 conventional papers of 3 hours and 200 marks each. Detail syllabus is as follows.

Electrical Engineering

Paper - I

Standard : Degree in Electrical Engineering

Total Marks : 200

Medium : English

Nature of Paper : Conventional Type

Duration : 3 Hours

Note :

- 1) Answers to this paper must be written in English only.
- 2) This paper will test the candidate's ability to comprehend, to analyse, to interpret, to criticise and to appraise subject matter related to the topics /sub topics mentioned below.
- 3) For judging candidates conceptual understandings, appropriate numbers of numerical problems will be asked.
- 4) It is expected from candidates to study the latest and recent developments and happenings pertaining to the topics / sub topics mentioned below.

Section : A (Marks : 40)

1. Work, Power and Energy, Resistance, capacitance and inductance, DC circuits, KCL, KVL, Network theorems,
2. AC fundamentals, RL, RC and RLC circuits, Steady state and transient responses. Series and parallel ac circuits, Three phase circuits, Power calculation in balanced and unbalanced circuits, Linear and non linear loads.

Section : B (Marks : 40)

3. Basics of electromagnetic and electrostatic, Series and parallel magnetic circuits, Energy stored in fields,
4. Types, construction, operation of single and 3 phase transformers, equivalent circuit and phasor diagrams, OC and SC tests, Regulation and efficiency calculation, Parallel operation, Field tests before commissioning,

Section : C (Marks : 40)

5. Fundamentals of energy conversion, Construction and theory of DC machine, DC generator characteristics, Starting, braking and speed control of DC motors, Application of dc machines.
6. Principle, types, performance characteristics, starting and speed control of single phase and three phase induction motors, Equivalent circuits, phasor diagrams, applications. VFD for induction motors. Energy saving opportunities in using VFD.

Section : D (Marks : 40)

7. Principle, types of synchronous motors, performance characteristics, starting and speed control of single phase and three phase synchronous motors, Equivalent circuits, phasor diagrams, applications. VFD for synchronous motors.
8. Analog and Digital electronics fundamentals, devices and characteristics, amplifier and oscillator circuits, Operational amplifier, Gates, Flipflops, Combinational and sequential circuits, ADC and DACs.

Section : E (Marks : 40)

9. Sensors and transducers, Performance characteristics of measuring instruments, instrument transformers, measurement of physical parameters such as pressure, force, temperature, flow, vibration, torque, etc.
10. Principles of feedback, transfer function, block diagram, steady state error, Steady state and transient specifications, Bode plot, Nyquist plot and Root locus, Relative and absolute Stability considerations.

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Electrical Engineering

Paper - II

Standard : Degree in Electrical Engineering

Total Marks : 200

Medium : English

Nature of Paper : Conventional Type

Duration : 3 Hours

- Note :**
- 1) Answers to this paper must be written in English only.
 - 2) This paper will test the candidate's ability to comprehend, to analyse, to interpret, to criticise and to appraise subject matter related to the topics/sub topics mentioned below.
 - 3) For judging candidates conceptual understandings, appropriate numbers of numerical problems will be asked.
 - 4) It is expected from candidates to study the latest and recent developments and happenings pertaining to the topics/sub topics mentioned below.
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Section : A (Marks : 40)

1. Power Devices- types, Characteristics of various power electronic devices, Triggering and protection circuits, Controlled and uncontrolled rectification, DC to DC converters, DC to AC conversion, modulation techniques, SPWM
2. Fundamentals of electric drives, 4 quadrant operation, theory and analysis of dc drives, converter and chopper fed dc drives, Voltage, frequency and V/F controlled ac drives, slip power recovery schemes, fundamentals of wind power generation and grid interface.

Section : B (Marks : 40)

3. Power generation in India and Maharashtra, Renewable Generation, Various types of power plant, major equipment in power plants, Major issues with wind and solar power generation and grid interface.
4. Steady state performance of overhead transmission lines and cables, per unit quantities, Bus admittance and impedance matrices, symmetrical components.

Section : C (Marks : 40)

5. Calculation of sag and tension in transmission lines, Analysis of symmetrical and unsymmetrical faults, principle of active and reactive power transfer and distribution.
6. Load flow studies, steady state and transient stability, voltage stability, voltage control, economic load dispatch, load frequency control in power systems.

Section : D (Marks : 40)

7. Principle of circuit breaking, arc extinction and arc interruption for ac and dc breaker, Various types of circuit breakers and their applications, Ratings of breakers, isolators and major HV switchgear.
8. Principle of over current, earth fault, differential, and distance protection. Concepts of solid state and numeric relays. Protection of generator, transformer, transmission lines, substation, busbar, induction motors. Various LT switchgear devices such as MCCB, ELCB.

Section : E (Marks : 40)

9. Specification of impulse wave, multistage impulse generator, insulation coordination, Routine and type tests for cables and transformers, Lightning protection, Early emission arrestors.
10. Power quality issues, Reactive and harmonic compensation, FACT devices and their applications, Passive and Active filters, HVDC transmission.

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Electrical Engineering

Paper - III

Standard : Degree in Electrical Engineering

Total Marks : 200

Medium : English

Nature of Paper : Conventional Type

Duration : 3 Hours

- Note :**
- 1) Answers to this paper must be written in English only.
 - 2) This paper will test the candidate's ability to comprehend, to analyse, to interpret, to criticise and to appraise subject matter related to the topics/sub topics mentioned below.
 - 3) For judging candidates conceptual understandings, appropriate numbers of numerical problems will be asked.
 - 4) It is expected from candidates to study the latest and recent developments and happenings pertaining to the topics/sub topics mentioned below.
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Section A (Marks : 40)

1. Energy scenario in India, Energy policies, pricing and reforms, Energy conservation act 2001, Electricity act 2003.
2. Energy management objectives, Electricity billing, electrical load management and MD control, Tariffs, PF improvements and benefits.

Section B (Marks : 40)

3. Basic terms in lighting systems and features, lamp types and their features, Recommended illumination levels for various tasks, methodology of lighting system energy efficiency study, Illumination system design for residential, commercial, industrial categories. Solar powered illumination and economics associated.
4. DG set selection and installation factors, Operational features, Energy performance assessment of DG sets, Energy saving majors for DG sets, Synchronization of DGs with utility supply. Parallel operation. UPS technology, types and specifications, Performance assessment.

Section C (Marks : 40)

5. Pump types and characteristics, Pump curves, Factors affecting pump performance, Efficient pumping system operation, Energy conservation in pumping systems. Fan and compressor types, Fan and compressor performance evaluation and efficient system operation, Compressor capacity assessment, Energy saving opportunities in fans and compressors.

6. HVAC and refrigeration system, Types of refrigeration system, Common refrigerants and properties, Compressor type and applications, Selection of suitable refrigeration system, Factors affecting performance and energy efficiency of refrigeration plants, Energy saving opportunities.

Section D (Marks : 40)

7. Underground cable and cable accessories, cable in underground structure, cable installation in conduit, cable joints, cable fault detection, over-current protection and lightning protection of underground systems, operation and maintenance of underground system.
8. Grounding systems, Equipment, Ground fault protection, Isolated neutral grounding, Grounding for hazardous locations, substation, tower grounding.

Section E (Marks : 40)

9. Substation design, bus designs, substation layout, grounding and ground grid design, substation structures, major substation equipment, auxiliary equipment, substation automation, Commissioning and start up.
10. Industrial, residential and commercial wiring, electrical system design, design and audio and video systems, Lifts and Elevator systems, safety norms and codes. Fire fighting apparatus and systems.

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3. Interview - 100 marks