

**Scheme for Limited Departmental Competitive Examination for promotion to the cadre of SDE(Electrical) from JTO(Electrical).**

1. Paper – I (Multiple Choice)      -      300 marks (3 hours)  
Paper – II (Descriptive)              -      300 marks (3 hours)
2. Negative marking shall be done for incorrect answer in paper-I. For every incorrect answer, 25 % of marks allotted for one question will be deducted.
3. No marks for evaluation of service records (i.e. ACRs) shall be done.
4. Minimum passing marks in each paper-  
50% for general candidates  
45% for SC/ST candidates.
5. The questions papers will be so designed as to assess the ability of the candidates to apply their technical knowledge to the solution of the problems.
6. Candidates are permitted to bring and use battery operated pocket calculators for subjective type paper-II.
7. Candidates are not permitted to take any book to the examination hall.

**Syllabus for Limited Departmental Competitive Examination for promotion from  
JTO (Electrical) to SDE (Electrical)**

**PAPER I (Multiplechoice)**  
( Maximum Marks = 300 – Time 3 hours)

**1. Measurements and Instrumentation:-**

**(60 Marks )**

Units and Standards. Error analysis, measurement of current, Voltage, power, Power-factor and energy. Indicating instruments. Measurement of resistance, inductance, Capacitance and frequency. Bridge measurements. Electronic measuring instruments. Digital Voltmeter and frequency counter. Transducers and their applications to the measurement of non-electrical quantities like temperature, pressure, flow-rate displacement, acceleration, noise level etc.

**2. Electrical Machines and Power Transformers:-**

**( 80 Marks )**

Magnetic Circuits - Analysis and Design of Power transformers. Construction and testing. Equivalent circuits. Losses and efficiency. Regulation. Auto-transformer, 3-phase transformer. Parallel operation.

Basic concepts in rotating machines. EMF, torque, basic machine types. Construction and operation, leakage losses and efficiency.

D.C. Machines. Construction, Excitation methods. Circuit models. Armature reaction and commutation. Characteristics and performance analysis. Generators and motors. Starting and speed control. Testing, Losses and efficiency.

Synchronous Machines. Construction. Circuit model. Operating characteristics and performance analysis. Synchronous reactance. Efficiency. Voltage regulation. Salient-pole machine, Parallel operation. Hunting. Short circuit transients.

Induction Machines. Construction. Principle of operation. Rotating fields. . Characteristics and performance analysis. Determination of circuit model. Circle diagram. Starting and speed control.

Fractional KW motors. Single-phase synchronous and induction motors.  
Alternators :- Basic principle & operation, characteristics & performance analysis, parallel operation

### 3. Power System:-

( 70 Marks )

Different types of a.c. switchgears, medium voltage a.c. switchgear, medium voltage H.R.C. fuses and their application. Outdoor switchgear. Busbars and busbar connections, different types of busbar systems, control board and switchboard diagrams. Substations -different types, factors governing the location of substation, diagram of connection of switchgear, isolators and transformers in a substation.

Short circuit calculations for symmetrical and unsymmetrical faults, use of current limiting reactors, determination of the rating of circuit breakers and switchgear. Application of symmetrical component theory for fault calculations, sequence impedances.

Power system transients. Power system protection circuit breakers, Relays, capacitors & power factor correction.

### 4. Analog and digital Electronics and circuits ( 30 Marks ):-

Semiconductor device physics, PN junctions and transistors, circuit models and parameters, FET, Zener, tunnel, schottky, photo diodes and their applications, rectifier circuits, voltage regulators and multipliers, switching behaviour of diodes and transistors.

### 5. Power Electronics:-

( 30 Marks )

- a) Devices :- Fundamentals and Principles in case of Power semi conductor devices – diodes, thyristors, power bipolar & transistors, MOSFETs their characteristics, AC/DC converters, Principles of Single phase and 3 – phase inverters,

### 6. Computer Engineering :-

(30 Marks )

- a) Fundamental of Microprocessor
- b) Digital Computers :- Logical and switching circuits. Boolean algebra. Postulates, theorems and Venn diagram. Logical operations. Universal logics and combinatorial switching circuits.
- c) Elements of Computer :- Organization of digital computers, block diagram, input – output devices. Paper tape and card punches. Storage devices, flip flops, magnetic core drum, tape and disc memories.



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**SYLLABUS FOR PAPER II**

( Maximum Marks – 300 – Time 3 hours )  
(Engineering Design and Construction Practice)

1. **Indian Electricity Act** : Indian Electricity Act 2003, Indian Electricity Rules as amended up to date, Safety procedures and practices. **(10 Marks)**
2. **Work Procedures** : General principles in preparation of estimates, Principles of analysis of rates, Award of works, Execution of works, measurement of work and preparation of bills- **( 10 Marks )**
3. **Lighting** : Principles of indoor and outdoor lighting design, Units and standards, types, characteristics and application of lamp in fittings and luminaries, Lighting calculations for indoor and outdoor applications. **( 15 Marks )**
4. **Specifications**: CPWD specifications for Electrical Works (internal and external), Systems of wiring for various types of buildings, their design, distribution system and testing. **( 10 Marks )**
5. **Earthing** : Design, layout, and installation procedures for Building/ Exchange earth, Lightning protection and Surge protection devices. **( 10 Marks )**
6. **Pumps**: Various types of water lifting Pumps, their selection and application, installation procedures and specifications. **( 15 Marks )**
7. **Fire Detection**: Different type of fire – extinguishers, their use and applications, Various type of Fire – detectors, their selection, Specifications, installation and testing procedures. Dry and wet-riser fire fighting installations, sprinkler systems, design and installation criterion, acceptance testing. **( 30 Marks )**
8. **Sub-Station**: Layout, design and specifications of indoor and outdoor Sub-station up to 33 kV with particular reference to telephone exchanges, Specifications / selection of cables, Cable – jointing and termination methods, Power distribution in Telephone Exchanges, Electric service connection, commissioning procedures and tests, Power supply tariffs, economics, Power factor correction. **( 30 Marks )**
9. **Lifts**: Design parameters and traffic analysis for selection of Lifts, classification, safeties, V.V.V.F drives and AC drives, Microprocessor controls. **( 20 Marks )**
10. **Energy Audit**: Energy Conservation Act 2001, quality of power (harmonics), Energy Audit (Methodology and instruments used) No Cost Measures, Low cost and High cost measures, Basics, brief description and use of Solar energy, Wind energy, Tidal energy, geothermal energy and Non conventional fuel viz. Agro waste, rice husk, coconut shell etc. **( 20 Marks )**

11. **DG Set:** Diesel power generation, Base load, Peak load, choice of sets (air cooled vs. water cooled, conventional vs. silent canopy,). Fuel power cycles, Vapour power cycles (Carnot & Rankine), Gas power cycles (Otto & Diesel). Internal Combustion Engines, Two and Four stroke compression ignition and spark ignition engines, Combustion phenomenon, detonation, Knocking, scavenging of two stroke engines. Fuel system, air & cooling circuit, Lubrication and cooling system and carburetion, protection/safety devices, Manual and Automatic mains failures start, General layout, installation, performance and testing of DG sets, classes of governor, turbochargers, pollution control norms. **( 40 Marks )**
12. **Air-Conditioning:** General principles of Refrigeration and Air-conditioning, Psychrometric chart, Evaporative cooling and ventilation, comfort air conditioning, comfort indices, Heating and cooling load estimation, Classification of systems, General principles of window / split air conditioners, package units, Direct and Chilled water type air conditioning plants. Water and Air-cooled condensing systems, their design & applications, structural requirements, buildings, water and power requirement, Environmental requirements for Electronic and Non Electronic exchanges, RLUs, Repeater stations etc. scheme of air conditioning, redundancy, filtration and efficiency etc. Specifications for installation, acceptance testing. **( 50 Marks )**
13. **Space requirement:** Space requirement for various Electrical and Electro – mechanical services, schedule of accommodation for various services, floor loading for A/C plant, Weather maker, Sub station and Generator sets, National Building Code/ National Electrical Code as applicable to Electrical and Electro-mechanical services. **( 20 Marks )**
14. **Operation and Maintenance:** Preventive and day to day maintenance checks in respect of all the electrical/electro-mechanical services in telecom installations, frequency of various tests prescribed by BSNL/DOT and equipment manufacturers, man-power deployment norms, costing norms etc. **( 20 Marks )**