

# **ITI ELECTRICIAN TRADE** WIREMAN TRADE

## (ENGLISH MEDIUM)

## **ITI ELECTRICIAN TRAINEE**

Subject + Topicwise MCQs

This book has been prepared according to the syllabus of "ITI ELECTRICIAN TRADE" for various Exams

TS SPDCL-JLM, TS NPDCL - JLM, SCCL- ITI Electrician Trainee, (cat- I), ISRO- N.R.S.C., ISRO- VSSC, A.P. CPDCL- Energy Assistant (JLM GR- II), A.P. SPDCL - Energy Assistant (JLM GR- II), A.P. SPDCL



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"ITI ELECTRICIAN TRADE",

**TECHNICAL SUBJECT.** 

First Edition – 2024

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## PREFACE



As competitive exams aspirants face stiff competition in this competitive world, a comprehensive book which covers concepts, PYQs, Model questions and clear explanation is essential to achieve the desired goal.

Keeping this need in mind, we are delighted to bring this book to you. This book is the result of our constant efforts to help aspirants reach their destination. Further, we emphasize that this book is suitable for **"ITI"** students for their technical exams.

This book has been written in a lucid manner keeping in mind the needs of aspirants.

For the benefit of aspirants, we have included the questions asked in previous years exams and also provided clear cut explanation to each question in a way which is understandable even to the average student.

We have also taken content and questions from various standard books.

Solving previous questions helps aspirants understand the level of difficulty in the exams and also familiarizes them with the kind of questions expected to be asked in the upcoming exams.

I am grateful to the staff of "**UpaStapana Institute**" for their continuous encouragement and immense support to write this book.

We strongly believe that this book is highly beneficial to you if you use it properly.

We hope we would become a part of your success.

ALL THE BEST.



Prepared by Er. Muralidhar Jadi sir, M.Tech EEE Technical Faculty.  $\sim III \sim$ 



## SCCL (Singareni Collieries Company Limited) ITI- Electrician Syllabus

NAME OF THE POST	SYLLABUS
ELECTRICIAN TRAINEE,	1. BASIC ELECTRICITY
CAT - 1	2. RESISTORS, CONDUCTRORS, INSULATORS AND INSULATING
	MATERIALS
	3. ELECTRICAL ACCESSORIES
	4. CIRCUIT BREAKERS
	5. EARTHING
	6. ELECTROLYSIS, CELLS AND BATTERIES
	7. CAPACITORS
	8. MAGNETISM AND ELECTROMAGNETISM
	9. ALTERNATING CURRENT
	10. BASIC ELECTRONICS
	11. MEASURING INSTRUMENTS
	12. D.C. GENERATORS
	13. D.C.MOTORS
	14. ALTERNATORS
	15. TRANSFORMERS
	16. POLYPHASE INDUCTION MOTORS
	17. SYNCHRONOUS MOTORS
	18. SINGLE PHASE MOTORS
	19. WINDING
	20. HOUSE SERVICE CONNECTIONS AND WIRING LAYOUT
	21. ILLUMINATION
	22. DIGITAL ELECTRONICS
	23. ELECTRICAL APPLIANCES
	24. RELAYS AND VOLTAGE REGULATORS
	25. GENERATION OF ELECTRICAL ENERGY
	26. TRANSMISSION AND DISTRIBUTION
	27. WORKSHOP CALCULATION AND SCIENCE
	28. EMPLOYABILITY SKILLS

IN ADDITION TO THE ABOVE, FEW QUESTIONS RELATED TO THE GENERAL KNOWLEDGE, GENERAL ENGLISH, GENERAL MATHS, I.Q., APTITUDE, TEST OF REASONING, NUMERICAL ABILITY, CURRENT AFFAIRS, COMPUTER BASICS ETC.





## SYLLABUS FOR THE POST OF JLM IN TS SPDCL, TS NPDCL SCHEME OF EXAMINATION

Paper	Subject	No. of questions	Duration (Minutes)	Maximum Marks
1.	I.T.I(Electrical Trade) and General Knowledge	80 Questions (I.T.I(Electrical Trade): 65 Questions and General Knowledge: 15 Questions)	120	80

#### PAPER A: I.T.I (Electrical Trade)- 65 Marks

- 1. Fundamentals of electricity: electrical occupational safety, tools, ohms law, Kirchhoff's law, series, parallel, Kirchhoff's law and star delta, problems- electrostatics and capacitors. Earthing principles and methods of earthing.
- 2. Batteries: primary and secondary, lead acid cells, methods of charging- testing and application of batteries, invertors, battery chargers and maintenance.
- 3. Magnetism: magnetic materials and properties- laws of magnetism- electromagnetism, electromagnetic induction.
- 4. Fundamentals of AC: simple problems of AC fundamentals, power, power factor, single phase and three phase circuits.
- 5. Basic Electronics: electronic components, rectifiers, amplifiers, oscillators and power electronic components.
- 6. DC Machines: construction, working principle and simple problems on DC generators and motors, speed control and applications of DC motors windings.
- 7. Transformers: construction, working principle, basic concepts and simple problems on transformers- windings-auto transformers, power transformers, CT & PT.
- 8. Ac machines: basic concepts, construction principle and simple problems on three phase and single phase induction motor, universal motor, alternators, synchronous motors and their applications and windings concept of power electric drives
- 9. Electric measurements different types of AC and DC measuring instruments, domestic appliances and illumination concepts types of electric lamps
- 10. Electric power generation-thermal, hydel and nuclear, transmission and distribution system basic concepts, non-conventional energy sources.



#### PAPER B: GENERAL KNOWLEDGE – 15MARKS

- 1. Analytical and numerical ability
- 2. Current affairs
- 3. Consumer relations
- 4. General science in everyday life
- 5. Environment issues and disaster management
- 6. History, geography and economy of India and telangana
- 7. History of telangana and telangana movement
- 8. Society, culture, heritage, arts and literature of telangana



## Syllabus for Andhra Pradesh Energy Assistants (JLM Grade-II)

#### 1. Fundamentals of Electrical Engineering

Electric current-conductors-semiconductors-Insulators, electric potential-resistance-law of resistance, effects of temperature on resistance in series, parallel and series-parallel, Kirchhoff's laws.

#### 2. Electro magnetism

Introduction to magnets, magnetic pole, magnetic axis, pole strength, properties of magnets, classification of magnets, Fleming left hand rule, field pattern of long straight conductor, solenoid.

#### 3. Electro Magnetic Induction

Concept of electro-magnetic induction Lenz's law-Fleming's right-hand rule, faraday laws of electromagnetic induction-types of emf s-dynamically and statically induced emf, self and mutual induction.

#### 4. Cells and batteries

Chemical effects of electric current-faraday laws of electrolysis, cells and their components- Definition of battery-primary cells –defects and remedies, dry cell-secondary cell-comparison between primary cells and secondary cells, lead acid cell-principle and working of lead acid cell detailed study-Wh & Ah efficiencies of cell, charging methods of secondary cells, maintenance of lead acid cell and testing of lead acid battery.

#### 5. Electrostatics

Definition of electric charge& its units, capacitance-definition and formula, types of capacitors, capacitors in series and parallel.

#### 6. Electrical Wiring accessories, wiring tools and wire joint

Types of switches with modern approach, other accessories like lamp holders, ceiling roses, sockets, fuses etc.(detailed study),fuses and fuse materials, MCB & CBs, wiring tools, wire joints, soldering, taping and termination of wires/cables and cable joints.

#### 7. Wiring system & wiring circuits

Types of house wiring-cleat wiring CTS/TRS wiring, conduit wiring, casing capping wiringdetailed study, comparison between different wiring methods, stair case wiring, series and parallel circuits, master switch circuits, corridor wiring circuits, fluorescent tube light circuit, flashers, moving lights.

#### 8. Earthing

Necessity of earthing-definitions of fundamental terms in earthing like earth, earth lead, earth electrode, earth wire etc, types of earthing-detailed study of pipe earthing



and plate earthing, specifications of materials used for earthing. Measurement of earth resistance.IE rules for earthing.

#### 9. IE rules for Electrical wiring

Precautions to be observed while installing different electric appliances in houses, I E rules regarding house wiring, causes of fire accidents due to electricity failures.

#### **10. Indicating Instruments**

Classifications of indicating type measuring instruments, effects of currents used in indicating instruments, torques/forces in electrical instruments, MC instruments – difference between MI and MC insts., extension of MI & MC instruments, measurement of power-dynamometer type, different types of errors in indicating instruments.

#### **11. Integrating Instruments**

Definition and classifications of integrating instruments, 1-ph, 3-ph phase induction type energy meters, errors in energy meters.

#### **12. Special Instruments**

Power factor meter, frequency meter, synchronoscope, instrument transformer CT-PT, multi meter, megger, tongue tester.

#### 13. Semiconductor Devices and Their Applications

Atomic structure and semiconductor theory, P-type and N-type materials, P-N junction, biasing and characteristics of diodes. Rectifier circuit – half wave, full wave, bridge rectifiers, transistors-types of transistors-configurations, applications, working of inverter and UPS.

#### 14. D.C Generators

Generators principle, simple loop generator, production of induced EMF and its nature, construction details of DC generators, yoke-poles-pole shoes-armature-commutatorbrush assembly bearing field coils, armature winding-lap and wave winding, EMF. Equation, types of generators-separately-self excited-series-shunt-compound wound, application of different types of generators.

#### 15. D.C. Motors

Principle of working significance of back EMF(Eb), types of dc motors, series-shunt and compound motors, speed and torque equation, speed control of motors-field control



method for series& shunt motors-armature control methods(for shunt motors only), DC motor starters-necessity of starter working of 3-point starter-4 point starter, applications of different types of motors.

#### 16. A C fundamental & Circuits

Definitions of alternating currents and voltage, different wave form, definition of cycle, time period, frequency, amplitude, instantaneous value, maximum, average and RMS values of A.C voltage & current, form factor, peak factor of sinusoidal wave, phasor representation of A.C, phase difference of ac, power & power factor. Single phase A.C. through pure resistive/ inductive/capacitive circuit – voltage – phasor diagrams – power – power factor, A.C. through R-L/R-C/R-L-C circuit current – voltage – phasor diagram power- power factor, poly phase circuitsadvantages of poly phase over single phase star and delta connection - voltage & current relation in star connection – delta or mesh connections, 3-phase power equation.

#### 17. Transformers

Transformer – its construction, working, performance, EMF equation, cooling of transformer, losses and efficiency, transformation ratio. Construction of core, winding shielding, auxiliary parts breather, conservator. Buchholz's relay, other protective devices, transformer oil testing, auto transformer – working, applications.

#### 18. Alternators

Principle and operation of alternators, relation between speed, number of poles and frequency, constructional details of alternator – salient pole type and smooth cylindrical type, EMF equation.

#### **19.** Three – phase Induction Motors

Classification of 3-Ph motors, working principle of 3-Ph induction motors, relations between Ns, no. of poles and supply frequency-definition of slip & slip speed, constructional details of induction motors-squirrel cage and slip ring motors, starters for induction motors necessity of starter-D.O.L starter-star/delta starter-rotor resistance starter for induction motor, applications

#### **20.** Single phase Induction Motors

Principle of operation of single-phase induction motors, types of 1-Ph induction motor like split phase, capacitor start – capacitor start capacitor run – shaded pole motors – their applications.

#### 21. Generation of power

Sources of electrical energy- conventional-non conventional energy sources, generation of electric power using conventional energy sources-working of hydel and thermal power stations.

#### 22. Transmissions and Distribution of power



Transmission of power from generating station to receiving stations, use of step-up and stepdown transformers and associated equipment, use of circuit breaker-isolators-earth switches, C.T.'s etc., distribution of power, transformer substations, distributions T/F substation-double pole structure-pole mounted and plinth mounted T/F, substation associated equipment such as A.B. switch, L.A. –H.G. fuse – circuit breaker.

#### 23. Planning ,Estimation & Costing of Wiring

Control panel elements, types and specifications, concept and principle of plan, estimation and cost. Preparation of complete house wiring layout, industrial wiring.

#### 24. Illumination

Introduction of illumination, terms & definition, laws of illumination, requirements of good lighting, intensity of light – importance of light, colour available. Construction, working & applications of – incandescent lamp, fluorescent tube, CFL, neon sign, halogen, mercury vapour and types, sodium vapour etc. decoration lighting.





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## **D.C. CIRCUITS**



## 1. D.C. CIRCUITS

## BASIC ELECTRIC CIRCUITS

## **SYNOPSIS**

#### **DEFINITIONS:**

- 1. Electric Network: The interconnection of two or more circuit elements called as electric network.
- Electric Circuit: The interconnection of two or more circuit element with at least one closed path is called as electric circuit.
- 3. Circuit Element: Circuit element refers to the mathematical model of a physical device.
- Types of circuit elements: There are mainly two types of circuit elements.
  - 1. General circuit elements
  - 2. Simple circuit elements

## **General Circuit Elements:**

A general circuit element may be composed of more than one simple circuit elements.

**Ex:** Transformer

## **Simple Circuit Elements:**

A simple circuit element is the mathematical model of a two terminal devices.

Ex: Resistor, Inductor.



## **Types of Simple Circuit Elements**

All the simple circuit elements can be classified according to the relationship of the current through the element, to the voltage across the element.

**Resistor:** if the voltage across the element is directly proportional to the current through it, then the element is a resistor.



Where R is the resistance in ohms.

## **Characteristics of Resistor**

V=IR

 Ohm's Law: Temperature remaining constant, the current
 passing through the conductor is directly proportional to the potential difference applied across
 the ends of the conductor, Mathematically

l∝V

V∝I

V=IR

Where the constant of proportionality R is called as the resistance in ohms.



$$1\Omega = \frac{IV}{A}$$

2. **Power** : The power absorbed by a resistor is given by

$$P=VI=IR=\frac{V^2}{R}watts$$

 Conductance: The reciprocal of resistance is called as conductance. The unit for conductance is mho (Ŭ).

## 4. Open Circuit and Short Circuit:

 Resistance may be used as basis for defining the terms short circuit and open circuit.

## a. Properties of Open Circuit:

- 1. Resistance is infinite  $R = \infty \Omega$
- 2. Current must be zero I=0 A
- 3. Voltage across open circuit may have any value.

## b. Properties of short circuit:

- 1. Resistance is zero R= 0  $\Omega$
- Voltage across short circuit must be zero V= 0 volts
- 3. Current may have any value.

## Inductor (L):

If terminal voltage is proportional to the time derivative of current through then that element is an inductor.



Where L is inductance is Henries.



LH= 
$$1\frac{V-S}{A}$$

## a. Characteristics of Inductor:

 There is no voltage across an inductor if the current through it is not changing with time i.e., an inductor acts as a short circuit to D.C. under steady state.

$$V = L \frac{di}{dt}$$

2. A finite amount of energy can be stored in an inductor even if the voltage across inductance is zero, such as, when a current isd.c.

i.e, 
$$E = \frac{1}{2} CV^2$$
 joules

- 3. It is impossible to change the current through an inductor by a finite amount in zero time.
  For this, it requires infinite voltage across it i.e., an inductor resists
- 4. An inductor stores energy in magnetic form and is given by  $E(f) = \frac{1}{2}L(I)^2$
- 5. The average power absorbed by it is zero.

## **Capacitor:**

If the terminal voltage is proportional to the integral of current through it then that element is a capacitor.