

SYLLABUS FOR INSTRUCTOR (WIREMAN) EXAMINATION UNDER LABOUR, EMPLOYMENT, SKILL DEVELOPMENT && ENTREPRENEUSHIP DEPARTMENT

GENERAL ENGLISH (100 marks)

- (a) Essay Writing (Conventional) 20 Marks
- (b) Idioms & Phrases (MCQ) 16 Marks
- (c) Comprehension of given passages (MCQ) 16 Marks
- (d) Grammar (MCQ) 16 Marks
- Parts of Speech : Nouns, Adjective, Verb, Adverb, Preposition, etc.
- (e) Composition (MCQ) 16 Marks
 - i) Analysis of complex and compound sentences
 - ii) Transformation of sentences
 - iii) Synthesis of sentences
- (f) Correct usage and vocabularies (MCQ) 16 Marks

TECHNICAL PAPER – 1:

150 Marks

- 1 Fundamentals of Electricity: 5**
 - (a) Electron Theory = Free electron. Valence electron
 - (b) Fundamental Terms and their units = Electromotive force (EMF), Potential difference(Pd) voltage, Current and Resistance

- 2 Electrical Engineering Materials: 10**
 - (a) Conductor = Qualities of good conducting materials wire, Cables and specifications, solid and stranded wire types of wire joints.
Soldering-solder, flux, brazing
 - (b) Insulators = Qualities of good insulator materials, common insulating materials, Thermal classification of Insulating materials
 - (c) Type of wire, cables , specification

- 3 Fundamental Laws of Electrical Engineering: 10**
 - (a) Ohm's Law = Application, Series, Circuit, Parallel Circuit and combined circuit. Conductance and its unit
 - (b) Law of Resistance = (Factor on which Resistance depend), specific resistance(Resistivity) and its unit Dielectric strength of insulation materials
 - (c) Kirchhof's Law = Point Law (current Law) and Mesh Law (Voltage-Law) their application, wheatstone Bridge-application
 - (e) Work, Power and Energy = Definition and their units, relations of electrical power and Horse power

- 4 Protective and Controlling Devices in Electrical Wiring: 5**
 - (a) MCB, MCCB, ELCB, RCCB = Their full form working specifications and applications
 - (b) Accessories = Switch, Holder, Plug, Sockets

5 Heating effects of electric current:		5
(a) Joule's Law,	= Temperature and heat, thermal efficiency	
(b) Effects of temperature on Resistance	= Temperature coefficient of resistance meaning. Temperature coefficient of common conductors	
6 Electrolysis, Cells and Batteries		15
(a) Faraday's Law of electrolysis	= Electrolysis, Cathode, Anode, Anion, Canion, Electroplating, Electrodes, Electrolyte	
(b) Primary Cells	= Definition, Different primary cells. Defects of primary cells and their remedies	
(c) Secondary Cells	= Definition, different secondary cells, constructions, Defects of secondary cells and their remedies. Method of charging, care and maintenance of secondary batteries. Specific gravity, Hydrometer, cell tester.	
(d) Grouping of Cells	= Series, Parallel and Combined connection	
7 Magnet and Electromagnets:		15
(a) Classes of Magnet	= Natural and artificial magnet	
(b) Types of Artificial Magnet	= Permanent and temporary magnet	
(c) Terms in Magnet	= Magnetic pole, Magnetic field, Magnetic lines of force, magnetic field strength, magnetic circuit, magnetic flux & unit, Flux density & its unit, Magnetic motive force, Reluctance, Permeability, Magnetic Retentivity, Magnetic saturation, Residual magnetism, Magnetic leakage	
(d) Magnetic Materials	= Diamagnetic Materials, Paramagnetic materials and Ferro-magnetic materials. Properties of good magnetic materials	
(e) Faraday's Law of Electromagnetic Induction	= Dynamically induced emf, statically induced emf, mutual induction and mutually induced emf, Fleming's Right hand Rule, Left hand Rule, Cork Screw Rule, Lenz's Law, End rule, Helix Rule. Inductance & its unit.	
(f) Magnetic Hysteresis	= Hysteresis loop, hysteresis loss, Eddy current and Iron loss	
(g) Force between two poles -	= Coulomb's Law	
8 Electrostatics :		10
Condenser (capacitor)	= definition, working principle coulomb's Law Electric charge and its unit, Factors determine capacitance of capacitor, Capacitance and its unit. Different types of capacitor and applications capacitors in series and parallel	

9 Earthing:

15

Meaning, Necessities of earthing, Body Earthing and system earthing. Permitted resistance, Z (impedance) of the earth system (resistance of earth + Earth continuity conductor R) to blow the fuse as per BIS 3043-1966 recommendations, size of earth continuity conductor in accordance with BIS 3043-1966.

Two types of earthing according to the earth electrode used. Size of plate earth electrode for Copper and GI plate, size of Pipe earth electrode. Recommended depth of earthing. Methods to measure earth electrode resistance. Steps to reduce earth resistance. Recommended earth resistance value for small installation (Wiring), sub-station and power plant. Bonding. Earthing of domestic fittings and appliances in accordance with BIS 3046-1966

Protection of earth wires (earth continuity conductors) IEE Regulations pertaining to earthing (NIMI)

10 Wiring installation:

15

- (a) Factors for selection of Type of wiring = Durability, safety, appearance & cost
- (b) Method of interior wiring installation = Casing Capping and conduit wiring
- (c) System of Wiring = Distribution system. IE Rules pertaining to domestic wiring and power (factory) wiring
- (d) NE Code pertaining to sub circuit, estimation of load requirements voltage drop, selection of supply system. Main and distribution board.
- (e) Metal conduit wiring including conduit earthing ISI Rules related to wiring (general)
IE Rules pertaining to wiring installation
- (f) Inspection and Tests of wiring
 - (a) Polarity Test
 - (b) Continuity or Open circuit Test
 - (c) Effectiveness of earth connection
 - = (d) Insulation Resistance Test - Between conductors (Phase to Neutral) between conductors to earth (Phase to earth and neutral to earth)
- (g) Grading of Cable and current ratings

11 Illumination (electric Lamps):

15

- (a) Light = Meaning and form of energy
- (b) Terms used in illumination and their units = Light, lumen flux, Lumen, Luminous intensity(I), solid angle, steradian, plan angle, candle power, Illumination, Foot candle, Lux or Metre-candle Brightness (Luminance), Glare. Mean Horizontal candle power, mean spherical candle power, mean Hemispherical candle power, Lamp efficiency, Waste light factor, Utilization factor and Depreciation factor
- (c) Laws of Illumination = Inverse square Law, Lambert's cosine law
- (d) Factors for illumination design = Space height ratio, utilization factor, maintenance factor Depreciation factor and Waste light factor
- (e) Characteristics of Good illumination
- (f) Different types of Lighting Scheme =
 - (a) Direct lighting
 - (b) Semi direct lighting
 - (c) Indirect lighting
 - (d) Semi Indirect lighting

- (e) Local lighting
- (f) General lighting
- (g) Steps for calculation of lighting design (illumination as per light-flux method)
- (h) Electric Lamps = (a) Incandescent lamp (metal filaments)
- (b) Arc lamps
- (c) Fluorescent lamps
- (d) CFL lamps
- (e) Gas discharged lamps - Mercury vapour lamps, Sodium vapour lamps
- (f) Neon and LED lamps

12 Alterating Current (AC) including Polyphase :

10

- (a) Comparison or advantages of AC over DC
- (b) AC fundamental terms = Cycle, time period, Amplitude or peak value, Fre-quancy, instanteneous value, RMS value, Average value, Form factor (Kp), Crest or Peak factor (Ka)
- (c) Generation of sine wave = Phase, in phase, out of phase, leading and lagging
- (d) AC circuit compnents/properties/ parameters = Resistance, inductance, capacitance and impedance with their respective units
- (e) Pure AC Resistive & its characteristics = Pure AC inductive circuit and its characteristics, pure AC capacitive circuit and its characteristics, X_L , X_C and impedance (Z)
- (f) AC Series circuit = R and L in series, L and C in series, R, L and C in series, Problems, series resonance, Q-factor, problems.
- (g) AC Parallel Circuit = Admittance(Y), inductive susceptance, capacitive susceptance.
- (h) Power factor = Meaning, Effects of low power factor, Power factor improvement.

13 Polyphase or three Phase :

10

Polyphase

Advantages over single phase, Generation of 3 phase, star and delta connection, Line voltage (V_L), Phase voltage (V_P), Line current (I_L) and Phase Current (I_P), Relations of V_L, V_P, I_L , & I_P in star and delta connection. Power in 3 phase balanced and unbalanced load. Method of Power measurement in 3 phase.

14 Measuring Instruments :

10

- A Classification of Instruments
 - (a) Absolute Instruments
 - (b) Secondary Instruments
 - (c) Indicating or deflecting type
 - (i) Integrating type
 - (ii) Recording type
- (b) Essentials in Indicating/Deflecting Instruments

- (a) Deflecting torque
- (b) Controlling torque- Spring and gravity control
- © Damping torque

(c) Types of Instruments

(i) Moving Iron Instruments

- (a) Attraction type
- (b) Repulsion type

(ii) Moving Coil Instruments

(d) Dynamometer type

Wattmeter and power factor meter

(e) Multimeter

Analogue and digital

(f) Energymeter

Analogue and digital

(g) Insulation tester/megger

Analogue and digital

(h) Frequency meter, phase sequence meter, Tong tester (clip on meter), Techometer

(i) Earth Tester

(j) Errors common in all instruments

Temperature error

Frictional error

Observation error

1 Electronics

10

- A Characteristics of semi-conductor/Properties of Semi-conductor
- B Type of semi-conductor - Intrinsic and Extrinsic
- C Two types of Extrinsic semi-conductors - N type and P type
- D P-N Junction - Biasing of PN - Forward and Reverse biasing
- E Diode as Rectifier - Working
- F Classification of Diodes
- G Coding of Semi-conductor devices
- H Importance of DC Rectifier
- I Types of Rectifier and workings = Half wave rectifier
Full wave rectifier
Full wave bridge rectifier
- J Filter in Rectifier-types of filter = (a) capacitor input filter
(b) Types of resistor, special type of resistors. Resistor colour code
(c) Series inductor filter
(d) Choke input -LC filter
(e) CLC or Pi filter
- K Heat Sink
- L Resisitors = Types of resistor, special type of resistors. Resistor colour code
- M Passive and Active components

2 Transformer

15

- A Definition, working principle
- B Types of Transformer = (i) Power transformer
(ii) Special transformer-
(a) Instrument transformers
(b) Current transformers
(c) Voltage transformer
(d) Welding transformer
(e) Auto transformer
- C Parts and Construction of Power Transformer
- D Ratings of Power Transformer
- E Transformation Ratio & problems on transformation ration
- F Performance, Losses and Efficiency of Transformer = (a) Transformer on No-Load-Open Circuit Test
(b) Transformer on Load
(c) Short Circuit Test
(d) Copper loss finding
(e) All day efficiency
- G Star and Delta connection in 3phase Transformer
- H Parallel Operation of Power Transformer

3 Alternnator

15

- A Definition, working principle and generation of AC voltage
- B Relation between speed, frequency and number of poles
- C Type of alternator according to the number of phase = (i) Single phase alternator
(ii) 3phase alternator
(i) Salient pole type
(ii) Smooth cylindrical type
- D Classification according to the rotor
- E Construction of alternator
Stator and Rotor, Prime mover and exciter
- F Generation of A.C. 3phase Voltage
- G Alternator rating, why KVA and not KW?
- H EMF equation of alternator
- I Parallel operation of alternator = Advantages of parallel operation, conditions to be observed for parallel operation. Methods of parallel operation
- J Load sharing between two alternators in parallel operation
- K Voltage Regulation of alternator
- L Brushless alternator

4 Synchronous Motor

5

Construction, working operation, speed, starting methods. Auto - synchronous motor uses. Synchronous motor for power factor correction. Uses of Synchronous motor

5 AC 3phase Induction Motor

20

Construction - stator and rotor

Working principle/production of rotating magnetic field

Slip and Torque in 3phase induction motor

Factors effecting torque

Types of 3phase induction motor = i Squirrel cage induction motor
ii Slip ring induction motor

Characteristics and speed control of induction motor Starting and necessity of starter in 3phase induction motor. DOL starter, star Delta starter and auto -transformer starter and Resistance type starter with their respective uses. Single phasing prevention. Losses & efficiency. Relation of speeds frequency and numbers of poles. Applications, care, routine test of induction motors

6 AC Sing phase motor

20

Classification of single phase motor

- A Induction motor/Construction = (a) Split phase motor
(b) capacitor start induction run motor
(c) Capacitor start capacitor run motor
(d) Capacitor run motor(permanent capacitor motors)
(e) Shaded pole motor
- B Commutator type motor/Construction = (a) Universal motor
(b) Repulsion motor
- i Principle of single phase motor - construction and working
 - ii Torque and speed characteristics of single phase motors
 - iii Reason of no starter for single phase motor
 - iv Uses of single phase motor of different induction motors
 - v Uses of single phase commutator type motor and characteristics
 - vi Fractional Horse power motor
 - vii Stepper motor, Reluctance motor

7 Conversion from AC to DC

5

Common methods used in conversion of AC to DC

- i Motor generator set
 - ii Rotary converter
 - iii Mercury Arc Rectifier
- Reasons of Rectifier preferable than other methods
- Types of Rectifiers
- i Copper oxide rectifier
 - ii Selenium rectifier
 - iii Semi-conductor diode rectifier

8 Common Electrical Appliances

10

Heating appliances = Heater, Electric Iron, electric Kettle, Soldering Iron, Room Heater, Immersion Heater, Geyser, Toaster, Electric range, Hair dryer

Factors on which heating appliances depend, Heating efficiency.
Electric Food mixer, Wet grinder, Calling Bell and Buzzer, Washing Machine

9 Common Electrical Appliances

20

Working principle, construction, parts of DC Machine

EMF equation. Collection of DC emf

Different types of D.C. Generator = i Series generator
ii Shunt generator
iii Compound generator

Characteristics of series, shunt and compound generators

OCC and LCC curve

Characteristics of compound generator = Cumulative compound
Differential compound

Armature reaction, GNP, MNP, prevention of armature reaction

Commutation = i Emf commutation
ii Resistance commutation
iii Interpole

Parallel operation of DC Generator

10 DC Motor

10

Terms used in DC motor = i Torque
ii Back emf, etc.

Polarity of interpole in DC motor

Types of DC motor = i Series motor
ii Shunt motor
iii Compound motor
Starters of DC motor i Three point starter
ii Four points starter

Speed control in DC motor

Reversion of direction of rotation of D.C. motor

11 Aptitude Test 20 marks

(a) Numerical And Figurework Tests: (4 Marks)

These tests are reflections of fluency with numbers and calculations. It shows how easily a person can think with numbers. The subject will be given a series of numbers. His/Her task is to see how the numbers go together to form a relationship with each other. He/She has to choose a number which would go next in the series

(b) Verbal Analysis And Vocabulary Tests: (6 Marks)

These tests measure the degree of comfort and fluency with the English language. These tests will measure how a person will reason with words. The subject will be given questions with alternative answers, that will reflect his/her command of the rule and use of English language.

(c) Visual And Spatial/3-D Ability Tests: (4 Marks)

These tests are used to measure perceptual speed and acuity. The subject will be shown pictures where he/she is asked to identify the odd one out; or which comes next in the sequence or explores how easily he/she can see and turn around objects in space.

(d) Abstract Reasoning Tests: (6 Marks)

This test measures the ability to analyse information and solve problems on a complex, thought based level. It measures a person's ability to quickly identify patterns, logical rules and trends in new data, integrate this information, and apply it to solve problems.