

## ELECTRIAL – GENERAL – HWH DIVISION

### QUESTION BANK

- 1) In regulator how many windings are available in Magnetic amplifier. Ans: ( a & c )  
a. 6 c. 4 b. 3 d. 5
- 2) Size of V belts used 4.5KW Alternator. Ans: ( c )  
a. C121 c. C122 b. C123 d. C124
- 3) Capacity of battery fuse in TL Coaches ( a )  
a. 35 A (HRC ) c. 16 A (HRC ) b. 63 A (HRC ) d. 5 A (HRC )
- 4) The gap between the two halves of axle pulley should be ( c )  
a. 0.5 – 1.0 mm c. 3.0 – 4.0 mm b. 2.0 – 3.0 mm d. 5.0 – 5.5 mm
- 5) What are the AH capacity of cells used in TL coaches ( c )  
a. 110 c. 120 b. 1100 d. 800
- 6) Name the Acid used in lead acid cells ( a )  
a. Sulphuric Acid c. Nitric acid b. Hydrochloric Acid d. Phosphoric Acid
- 7) Give the Spg & Voltage of Fully charged cells ( a )  
a. 1220 & 2.2 a. 1200 & 2.2 b. 1220 & 2.1 b. 1200 & 2.1
- 8) Cut in speed for B/L alternator in TL application ( c )  
a. 21 c. 19 b. 20 d. 18
- 9) Inverter converts ( a )  
a. DC to AC c. AC to AC b. DC to DC d. AC to DC
- 10) IGBT are used as ( a )  
a. High frequency switching device c. Low frequency switching device b. Illuminating device  
d. Amplifier
- 11) Boost charge of VRLA cells ( a )  
a. 2.3 V/Cell c. 2.25 V/Cell b. 110 V/Cell d. 115 V/Cell
- 12) Trickle charging of VRLA cell ( c )  
a. 2.3 V/Cell c. 2.25 V/Cell b. 110 V/Cell d. 115 V/Cell
- 13) No of MA's in 4.5 KW regulators ( a )  
a. 1 c. 2 b. 3 d. 4
- 14) No of ET in 4.5 KW regulators ( a )  
a. 1 c. 2 b. 3 d. 4
- 15) Rectifier converts ( b )  
a. DC to AC c. AC to AC b. AC to DC d. DC to DC
- 16) Give the half load setting of R/R for TL application ( a )  
a. 19 Amps c. 21 Amps b. 20 Amps d. 22 Amps
- 17) Required level of Illumination for Ordinary sleeper coach ( c )  
a. 14 Lux c. 20 Lux b. 22 Lux d. 16 Lux
- 18) Give the tension length of spring used in Tension rod of 4.5 KW Alternator ( a )  
a. 310 mm c. 269 mm b. 265 mm d. 275 mm
- 19) Why lead acid cells are called as Secondary cells ( c )  
a. Since it can't be recharge c. Since it can be recharge b. Since it can't charge initially  
d. None
- 20) Name the method to be used to find out Earth leakage ( a )  
a. Double test lamp method  
c. Tong tester method b. Multi meter method d. Volt meter method
- 21) Voltage setting in VRLA cells for Express & passenger trains is ( c )  
a.  $128 \pm 0.5V$  &  $127 \pm 0.5V$  c.  $127 \pm 0.5V$  &  $128 \pm 0.5V$  b.  $125 \pm 0.5V$  &  $125 \pm 0.5V$  d.  $124 \pm 0.5V$  &  $122 \pm 0.5V$
- 22) If alternator is not generating voltage, the reason would be ( d )  
a. Field may be open c. Dropping of V-belts  
b. Fuse in regulator had blown d. All the above
- 23) The size of bus bars recommended to use in 4.5KW ERRU is ( b )  
a. 90 Sq. mm c. 50 Sq. mm b. 16 Sq. mm d. None
- 24) Terminals of IGBT are ( b )

- a. Base, emitter, collector c. Gate, source, drain b. Gate, emitter, collector d. None
- 25) No. of zeners connected across the primary of the step down transformer of power module. ( a )  
a. 4 c. 2 b. 3 d. 1
- 26) Name of the meter used to measure Air velocity ( c )  
a. Multi meter b. Thermometer c. Anemometer d. Ammeter
- 27) Name the Electrolyte used in lead acid cells . Ans:( a )  
a. Sulpheric Acid c. Nitric acid b. Hydrochloric Acid d. Phosphoric Acid
- 28) Inverter converts ---- ( a )  
a. DC to AC c. AC to AC b. DC to DC d. AC to DC
- 29) Capacitor bank are used at substations to ( c )  
a. Avoid short-circuiting c. Improve P.F b. Improve load factor d. Supply power in emergency
- 30) Circuit breaker is ----- ( a )  
a. Current breaking device c. Amplifier b. Attention device d. Starting device
- 31) PSI is the unit of----- ( a )  
a. Pressure c. Humidity b. Temperature d. Velocity of gas
- 32) Rectifier converts----- ( b )  
a. DC to AC c. AC to AC b. AC to DC d. DC to DC
- 33) Maximum permissible value of Earth Resistance for a small sub-stn? ( c )  
a. 0.5  $\Omega$  c 2.0  $\Omega$  b 1.0  $\Omega$  d 8.0  $\Omega$
- 34) Medium Voltage is clarified as ( d )  
a. Less than 250V c Above 33KV b 650V to 33KV d 250V to 650V
- 35) Single Phasing preventer is used to prevent? ( c )  
a. Single Phase voltage b Three phase voltage c Motors from single phasing d Motor to start
- 36) What is the minimum safe value of insulation resistance for Motors? ( a )  
a 10 M  $\Omega$  b 15 M  $\Omega$  c 5 M  $\Omega$  d 20 M  $\Omega$
- 37) The dimensions of earth electrode? ( b )  
a. 3.0 mtr length x 40 mm dia x 3.2mm thick b 2.5 mtrs length x 50mm dia x 3.2mm thick y c  
3.0 mtrs length x 50mm dia x 3.2mm thick d 2.5mtrs length x 40mm dia x 3.2mm thick
- 38) Earth Megger used ( d )  
a To measure insulation resistance of cables b To measure voltage c To measure current d  
To measure insulation resistance of earth
- 39) Illumination levels measured by ( a )  
a Lux Meter b Hydrometer c Anemometer c Multimeter A Generation, Transmission & Distribution of Electrical Energy
- 40) The integration time employed by supply authorities for recording M.D. for a 33 kV/415 V, 10 MVA Sub-station is – ( c )  
a 5 minutes b 15 minutes C 45 minutes d 60 minutes
- 41) While designing a sub-station anticipated future loads in the next.... Years are taken: ( d )  
a 1 year b 2 years c 20 years d 5-7 years
- 17) As per the present Tariff the minimum power factor of sub-station should be ( c ) a 0.8 b 0.85 c 0.98 d 0.95
- 42) The 3 phase voltage unbalance in supply should not exceed ( a )  
a 2.5% to 5% b 20% c 25% d 10%
- 43) For maintaining power supply quality the rate of change of frequency should not exceed ( c )  
a 5Hz/Sec b 10Hz/Sec c 1 HZ/Sec d 3 Hz/Sec.

### **WRITE DOWN THE ABBREVIATIONS:**

- 1 PWM : Pulse Width Modulation.
- 2 VRLA : Valve Regulated Lead Acid
- 3 IGBT : Insulated Gate Bi polar Transistor
- 4 FRPCPY : Failure Rate Percentage Per Year.
- 5 BTU : British Thermal Unit. 6 IOD : Injured On Duty.
- 7 LAP : Leave at Average Pay
- 8 LHAP : Leave at Half Average Pay
- 9 CL : Casual Leave
- 10 PNM : Permanent Negotiable Machinery
- 11 AIRF : All India Railway men federation.
- 12 NFIR : National Federation of Indian railways.
- 13 DA : Dearness allowance
- 14 TA : Traveling allowance or transportation allowance
- 15 LWP : Leave without pay
- 16 CCA : City compensatory allowance.
- 17 PATB : Passenger alarm terminal board
- 18 EFT : Emergency feeding terminals
- 19 PELE : Portable emergency lighting equipment
- 20 IRIEEN : Indian railways institute of electrical engineers
- 21 PERT : Programme evaluation & review techniques
- 22 DGS&D : Director General of supply and Disposal
- 23 EMD : Earnest Money Deposit 24 SD : Security Deposit
- 25 BG : Bank Guarantee 26 PG : Performance Guarantee
- 27 CRI : Colour rendering Index
- 28 D&G charges : Direction & General charges
- 29 PPCP : Poly Propylene Co-polymer 30 EEPROM : Electrically Erasable Programmable Read Only Memory

### **III. FILL IN THE BLANKS:**

- 1) The process of removing heat from low temperature level and rejecting at high temperature is called REFRIGERATION.
- 2) Any substances for change of its state at constant temperature absorbs/give up heat is called LATENT HEAT.
- 3) The sum of sensible heat and latent heat of substance in process is called ENTHALPY.
- 4) The latent heat of fusing ice is 144 BTU/LB.
- 5) The unit of refrigeration is TON OF REFREGIRATION – 12000 Btu/Hr or 3023.98 K.Cal/Hr.
- 6) The temperature measured by ordinary thermometer is called SENSIBLE HEAT. C.°
- 7) What is the boiling point of water **100 C.**
- 8) AT what temperature water starts freezing\_ 0 c
- 9) One watt is 3.412 BTU.
- 10) One BTU is 0.252 K.calaries.
- 11) The unit of heat is BTU OR K.CAL
- 12) RMPU means ROOF MOUNTED PACKAGE UNIT
- 13) The setting of HP cutout in RMPU coaches is 415 psi.
- 14) The setting of LP cutout in under slung coaches is 35 psi.

- 15) The boiling point of refrigerant R22\_ -40.8 C.
- 16) The boiling point of refrigerant R12. – 29.8c
- 17) Artificial respiration is required to the person met with electrical accident.
- 18) The rating of alternator in TL coaches is 4.5 KW.
- 19) The latent heat of evaporation IS THE HEAT REQUIRED TO CHANGE THE LIQUID INTO VAPOUR.
- 20) The temperature maintained in the refrigerator is LESS than 0°c
- 21) Resistances commonly used in power circuit are wire wound resistor.
- 22) The moisture absorption in refrigeration circuit is done by DEHYDRATOR CUM FILTER.
- 23) The commonly used refrigerants are R 12 & R 22
- 24) The lubrication of system in the sealed compressors is done by FREEZOL
- 25) The 3-phase voltage unbalance in supply should not exceed 2.5. % To 5%
- 26) For maintaining power supply quality the rate of change of frequency should not exceed 1  
HZ/Sec.
- 27) The voltage of 11 KV supply is 11000V
- 28) Tender Notice is to be published for Open tender
- 29) Copper is the good conductor of electricity.
- 30) Completion estimate is not required for calling tender.
- 31) Contingencies charges mean Transportation charges.
- 32) Detailed estimate is to be prepared for sanctioned works.
- 33) Detailed estimate needs sanction of HOD.
- 34) The fire extinguisher used for Electrical fire is CO2
- 35) Fire is the combination of material and temperature & Oxygen.
- 36) B Type of fire extinguisher used to nullify the oil fires.
- 37) Electric type of fire is clarified as D type.
- 38) CO2 type fire extinguisher is used for electrical fires.
- 39) Ordinary fire can be extinguished by water.
- 40) RUBBER HAND GLOVES are to be used while operating isolator handle in substations.
- 41) Ordinary fire can be extinguished by WATER OR SAND.
- 42) Artificial respiration is required to the person met with ELECTRICAL accident.
- 43) What is IOD? INJURED ON DUTY
- 44) What is meant by fatal accident? THE ACCIDENT CAUSES WITH LOSS OF HUMAN LIFE
- 45) If a man touches a live wire, he gets SHOCK. /electrocuted.
- 46) CTC type extinguisher is used for ELECTRICAL fire.
- 47) If a transformer catches fire FOAM type of fire.
- 48) The fire extinguisher used for Electrical fire is CO2 TYPE.
- 49) Fire is the combination of Material, temperature and oxygen
- 50) B type of fire extinguisher used to nullify the oil fires.
- 51) Electric type of fire is clarified as D type.
- 52) CO2 type fire extinguisher is used for ELECTRICAL fires.
- 53) Soda ash type fire extinguisher is used for GENERAL fires.
- 54) CTC OR FOAM type of fire extinguishers will be used to extinguisher chemical fires.
- 55) The system voltage in TL coaches is 110 V DC supply.
- 56) Monoblock type & 120 Ah capacity of batteries are used in TL coaches.
- 57) The codal life of lead acid batteries is 04 years.

- 58) The codal life of VRLA batteries is 04 years.
- 59) The 35 SWG size of fuse wire is used for each fan or light in distribution fuse board.
- 60) The voltage setting of 4.5 KW alternator at regulator is  $123 \pm 0.5$  volts.
- 61) If a cell is found less than 1.7 volts, it is considered as defective.
- 62) The wattage of 400 mm DC fan in TL coach is 35 watts.
- 63) The specific gravity of sulphuric acid which is used to make as electrolyte is 1.835.
- 64) The working voltage of 20W/TL inverter is 110 volts DC.
- 65) 16A HRC fuse is used for L1, L2 & fan circuit in RJB of TL coaches.
- 66) 100 KVA inverter capacity is used for cell phone charger in TL coaches.
- 67) The gap between wheel edge to axle pulley edge is  $145\text{mm} \pm 3\text{mm}$ .
- 68) The gap between the mounting bracket to adjustment nut of tension device for 4.5 KW alternator is 75mm.
- 69) Earht fault can be detected by using double test lamp or multi-meter.
- 70) The capacity of alternator, batteries & fans in TL coach are 4.5KW, 120Ah & 35W.
- 71) Transformer secondary volts =  $P.V. \times \frac{(S.T.)}{P.T.}$ . Note: PV: Primary Volts ST: Secondary Turns PT: Primary Turns
- (a) Primary Amps (b) Secondary Amps (c) Secondary Turns
- 72) Minimum insulation value of transformer of 400V winding with 500V Megger is 2 M Ohms
- (a) 2 M Ohms (b) 10 M Ohms (c) 50 M Ohms (d) 15 M Ohms
- 73) Breather is packed with material Silica Gel
- (a) Silaca Jel (b) Oil 20 KV
- 74) The minimum BDV of transformer Oil is 40 KV
- (a) 40KV, (b) 50KV (c) 55 KV
- 75) Earth fault relays providing against Earth Fault
- (a) Earth fault (b) Core beating (c) Full of oil level
- 76) Over current relays providing against Over current
- (a) Over current (b) Over voltage (c) Earth fault
- 77) MCCB is..... case circuit breaker Moulded
- (a) Miniature (b) Moulded

**IV. INDICATE TRUE OR FALSE TO THE FOLLOWING:**

- 1) Without EMD the tender offer is valid.  
False
- 2) Amps is the unit of current  
True
- 3) Wood is the bad conductor of electricity.  
True
- 4) AB Switch is used to break and make the power supply in OH Mains.  
True
- 5) Oil is used as a insulation in the power transformers.  
False
- 6) Finance vetting is required, if the cost of NS item exceeds Rs.1,00,000/- while procuring through COS.  
True
- 7) The Open tenders are to be opened in presence of a Accounts Office.

True

8) Blue is the color of pure silica

True

9) Internal Wiring system

True

10) Oil is used as a insulation in the power transformers.

False

11) The minimum capacity of power transformer on electrical General Services is 100KVA

True

12) The advantages of ERRU is to obtain pure DC supply and inbuilt over voltage protection.

True

13) The voltage of alternator in running condition cannot be checked at Roof Junction Box.

False

14) The cell voltage of TL coach is 2.2V.

True

15) TL coach alternator produces 35 Amps current.

False

16) The change of liquid state into vapour state is called evaporation.

True

17) Compressor works like a pump by drawing refrigerant vapour from the evaporator and sends to condenser.

True

18) 40 SWG capacity wire is used as fuse wire for fan or light in Distribution Fuse Board.

False

19) The working voltage of 20W/TL inverter is 150V D.C.

False

20) Double test lamp method is adopted to detect earth leakage in a TL coach.

True

21) The maximum permissible voltage drop allowed between the battery and any of the farthest light/fan point shall not exceed 3 volts at battery voltage of  $108 \pm 2$  volts.

True

22) Flame retardant low tension tape is used for insulation of cables in TL & AC coaches.

True

23) Constant voltage method of charging is adopted for charging lead acid cells during POH.

False

24) The width of alternator pulley of 4.5 KW 110V is 140mm.

False

25) Shorting of power diode test to be conducted at full load.

True

26) Bus bars provided in ERRU shall be made of electrolytic copper.

True

27) Wood is the bad conductor of electricity.

True

#### **V. SHORT ANSWER TYPE QUESTIONS:**

##### **1) What are the Fire prevention measures followed in coaches?**

Ans: Adequate and proper maintenance of Electrical devices in the coaches as per laid norms. • All electrical equipments should be maintained properly. • Check all the electrical circuits for foul (burning) smell, smoke and sparks. • After completion of the loading, guard must ensure that all the lights in the luggage portion of the • SLR are switched “off” to eliminate possibility of short-circuiting. Electrical junction boxes should be covered and locked positively in all TL coaches especially in • pantry cars. Ensure all electrical connections are intact and there are no loose fittings in the coaches. • Do not allow battery boxes in ‘open’ condition and also MS sheet covering is provided in electrical • circuits. Ensure correct rated Over load, over voltage protection, fuses/MCBs are provided in electrical • circuits. Ensure the availability and proper knowledge of usage of fire extinguishers in AC coaches. •

##### **2) What are Levels of electrical protections in TL coaches?**

Ans: a. Battery: TL coaches are provided with 120 Ah, 110 V flooded type Lead Acid Battery or VRLA battery. 40 A HRC fuse provided in main positive side of Battery circuit in under frame. b. Alternator & Regulator: TL coaches are provided with 4.5 kW alternator & RRU/ERRU. 35 A HRC fuse is provided in one phase of AC input. 6 A HRC fuse is provided for field control circuit. c. Fuse cum rotary switch panel 35 A HRC fuse is provided in main –ve circuit. L1 & L2 lighting circuits are provided with 16 A HRC fuse each in +ve side. Fan is provided with 16 A HRC fuse in +ve side. SPM circuit is provided with 16 A HRC fuse in +ve side. d. Fuse Distribution board 35 SWG re-wirable fuse is provided in both +ve & -ve sides for all individual light & fan fitting. Each Laptop/mobile charging point is provided with 500 mA/1.0 A fuse in both +ve & -ve sides. Emergency light circuit is provided with 6 A HRC fuse in both +ve and –ve sides.

##### **3) What are the main components of Lead Acid Cell?**

Ans. Main Components of Lead Acid Cells are: (i) Positive Plates which are tubular in shape made of PBO<sub>2</sub>. (ii) Negative Plates usually consists of a lead grid into which active material of Sponge lead is pressed. (iii) Separators which are made by Synthetic used between positive and negative plates. (iv) Container is made of hard rubber or PPCP with high insulating strength to resist acids which are used as Electrolyte. (v) Cells cover which covers container having vent plugs and level indicator.

**4) What type of batteries are used in TL coaches. Explain briefly about each one of them?**

Ans. In TL coaches two type of batteries are used. They are VRLA & SMF batteries. VRLA batteries: These are the Valve Regulated Cells which works on Oxygen Recombination Principle. SMF batteries: To overcome problems of frequent topping up and leakage of electrolyte sealed maintenance free batteries are developed. Electrolyte in SMF batteries is in immobilized form and these can be used in any position.

**5) What do you mean by PELE box and when it is utilized?**

Ans. The equipments available in PELE box are: i. TRIPOD STAND ii. HOLDER iii. FLEXIBLE WIRE 25 METERS iv. CROCODILE CLIPS v. BULBS vi. HAND LAMP vii. LOG BOOK viii. LAMP FITTINGS These equipments are used in emergency conditions of train service. This box is kept in the Guard Compartment.

**6) What are the Safety Checks in under gear and batteries?**

Ans: Alternator:- 1. Alternator safety chains 2. Suspension pin with anti- rotation plate and cotter pin 3. Suspension pin with nylon bushes 4. Alternator pulleys Axle pulley :- 1. Axle pulley with bolts and split pins. Battery box:- 1. Condition of battery box channels 2. Check nuts with split pins. Regulator Availability of nuts & bolts with split pins Availability of nuts & bolts with split pins of other under gear electrical suspension equipments.

**7) How to check Earth fault with Double Test Lamp?**

Ans: Double test lamp having three leads. Centre lead should be connected to earth, left side lead to be connected on positive side (+ve), right side to be connected on negative side (-ve) If both bulbs glow dimly it indicates no earth in the coach. If left side bulb glows brightly it indicates negative earth (-ve) in the coach. If right side bulb glows brightly it indicates positive earth (+ve) in the coach.

**8) What are the precautions to be taken while working in RE area?**

Ans: No one shall attempt to work on any overhead line running alongside the electrified tracks without taking special precautions of earthing on both sides of the work. Minimum 2m electrical clearance from live OHE of the adjacent track or any other equipment nearby must be maintained. During foggy/cloudy weather conditions, wear safety shoes, insulated rubber gloves and tools with insulated handles should be used to protect from induction effect. Steel tape or metallic tape or tape with woven metal reinforcement should not be used. Always carry the ladders/lengthy items in horizontal position instead of vertical. While attending to platform lights (in COP/OPEN area), the ladders shall be properly secured to avoid accidental fall in OHE.

**9) (a) Define Ohms Law?**

Ans. Temperature remaining constant the flow of current is directly proportional to applied Voltage.  $V, I = V/R$  (resistance of the conductor)  $\propto I$

**(b) Define Kirchoff's Voltage Law?**

Ans. It states, " the sum of the Voltage drops around a DC series circuit equals the source or applied voltage.  $E = E_1 + E_2 = E_3$ .

**(c) Define Kirchoff's Current Law?**



Ans. It states " the current flowing toward a point in a circuit must equal to the current flowing away from that point.  $I = I_1 + I_2 + I_3$ .

(d) State Faraday's laws of electromagnetic induction?

Ans. First Law: Whenever the flux linked with a circuit is changed an e.m.f. is induced in the circuit  
Second Law: The magnitude of the induced e.m.f is equal to the rate of change of flux linkages.

**10) Find the current load (IL) in the below mentioned circuit diagram ?**

Ans.  $(2+2) \times 4$  Resistance of third loop =  $2\Omega$   $(2+2) \times 4 \times 2$  Resistance of second loop =  $2\Omega$   
 $(2+2) \times 4$  (i)  $I_1 \times 2 = I_2 \times 4 = I_L \times 4$ . (ii)  $I_1 + I_2 + I_L = 2A$ .  $I_1 + I_1 \times 2/4 + I_1 \times 2/4 = 2A$ .  $I_1 [ 1 + 0.5 + 0.5 ] = 2$ .  $I_1 = 2/2 = 1A$ .  $I_L = I_1 \times 2/4 = 1 \times 2 = 0.5A$ . Hence,  $I_L = 0.5A$ .

**11) Give the charge and discharge reaction of the lead acid battery?**

Ans. Anode Electrolyte Cathode Discharge Anode Electrolyte Cathode  $PbO_2 + 2H_2SO_4 + Pb$   
 $PbSO_4 + 2 H_2O + PbSO_4$  Lead dioxide Sulphuric acid Sponge lead Charge Lead sulphate  
Water Lead sulphate

**12) What is the difference between SG TL coaches and LHB TL coaches?**

Ans: Sl.No Item description SG TL Coach LHB TL Coach  
1 Coach load distribution From Roof junction Box Power panel 2 Fuse distribution board Available Integrated in the power panel  
3 Fans DC fans AC fans ( 2.5 KVA 110 V Dc/AC inverters 2 no's) 4 Pantry car Single alternator, single set of battery Two alternators, Double set of Battery

**13) What are the safety items to be inspected on battery?**

Ans: Safety items to be checked on battery are full complements of battery box fixing bolts and its tightness, observation of its bottom plate and side plates for damage, full tightness of cell packing, proper securement of anti theft arrangement and battery box cover, full tightness of inter cell connections with double fasteners, correct size of battery fuse, elimination of earth leakage and maintenance of correct polarity, e.t.c,

**14) What are the safety items to be inspected on Rotary Junction Box?**

Ans: Safety items to be checked on rotary junction box are full tightness of all terminal connections, provision of correct size of HRC fuses, maintaining correct polarity of incoming and outgoing cables, avoiding earthing and shorting of cables.

**15) What are the safety items to be inspected on wiring?**

Ans: Safety items to be checked on wiring are securing of wiring through cleats with trough casing, provision of correct size of fuses in wiring circuits, elimination of lower size cables, provision of PVC bushes when ever wires passing through metal parts, eliminations of temporary wiring, avoiding of earthing and shorting of cables etc.

**16) What are the reasons for loss of residual magnetism? How do you regain it? What is the permissible and maximum DC voltage is to be applied to regain the residual magnetism?**

Ans. The reasons for loss of residual magnetism are keeping the alternator in idle condition for long time and connecting field wires in wrong polarity. To regain the residual magnetism flash the field terminals for correct polarity of DC supply. The permissible DC voltage is to be applied to regain the residual magnetism is 6 to 12V DC. Maximum voltage is 24V DC.

**17) What is the purpose of belt-tensioning device? What are the parts it consists of?**

Ans. The purpose of belt tensioning device is to keep V belts in tight condition. Its parts are  
1. Tension rod 2. Tension spring 3. Belt tension indicator with spring seat 4. Fork eye 5. Fork  
eye side spring seat 6. Belt tightening nut 7. Free end pipe and nut

**18) What are the main components of Lead Acid cell?**

Ans. Main components of Lead Acid cells are: a) Positive Plates, which are tubular n shape,  
made of  $PbO_2$  b) Negative Plates, usually consists of lead grid into which active material of  
Sponge lead is pressed. c) Separators, which are made by Synthetic, used between Positive  
and negative plates. d) Container is made of hard rubber or PPCP with high insulating  
strength to resist acids which are used as Electrolyte. e) Cell covers which covers container  
having vent plugs and level indicator.

**19) Enumerate the cable sizes used in TL coaches?**

Ans. Roof wiring Branch wiring : 4 sq.mm Aluminium, LI, LII & F+ve : 16 sq.mm Aluminium,  
SPMI&II : 16 sq.mm Aluminium. Under frame wiring Alternator to regulator, field winding : 6  
sq.mm copper. Main windings : 16 sq.mm copper, Regulator to under frame junction box :  
35 sq.mm Al. UFJB to Battery box : 35 sq.mm Al.

**20) Why earthing is necessary for any electrical equipments, domestic installation & service building etc?**

For TL coaches what is the minimum I.R. value required for new wiring? Ans: To drain away  
any leakage of currents due to poor insulation and to save human life from dangerous shock  
and also to avoid burnt of electrical equipment. The minimum IR value required for wiring is  
 $2M\Omega$ 's and minimum IR value required in service for giving coach fit for service is  $1M\Omega$ .

**21) Practically demonstrate how to use Fire extinguisher?**

Ans: a) P -Pull the pin at the top of the extinguisher. b) A -Aim the nozzle towards the base  
of the fire. c) S -Stand approximately 8 feet away from the fire and squeeze the handle to  
discharge the extinguisher. d) S -Sweep the nozzle back and forth at the base of the fire.

**22) What are the precautions to be taken before starting work on electrical installations?**

Ans: Before starting any electrical works on installations disconnect the power supply to the  
Electrical equipment and discharge & connect earth. If any capacitors are connected, it has  
to be discharged properly. Test with meters for any availability of supply then start the  
work.

**23) How do you conduct insulation resistance test on 100 VA inverter used for Laptop and mobile charging sockets used in RC SG coaches?**

Ans: The insulation resistance of the inverter shall be measured with 500v megger as given  
below: a) Between input terminals shorted together and the housing with output being kept  
in open circuit condition. b) Between the output terminals shorted together and keeping the  
input terminals in open circuit. The insulation resistance values measured thus shall not be  
less than 10 Mega ohms in each test.

**24) Write about the working principle of TL/AC alternator?**

Ans. The core of the stator which is completely embraced by the field coils, will retain a  
residual magnetism if excited by a battery once. The flux produced by the filed coils find its  
path through the rotor. When the rotor is rotated the passage of rotor teeth and slots,  
alternatively, under the field, offers a varying reluctance path for the flux produced by the  
field coils. The flux, which varies periodically, links with AC coils and induces an alternating  
voltage in AC coil. The frequency of the induced voltage depends on the speed of rotor,

where as the magnitude depends on the speed of the rotor and the level of excitation. The field is controlled through regulator to attain desired output voltage by means of positive feedback again.

**25) What are the precautions to be taken while loading and unloading of alternator?**

Ans. i) While unloading and loading alternator, see that the terminal box and pulley should not be broken. ii) The alternator to be loaded in correct way that bushes to be provided in proper place. iii) While loading and unloading proper precautions to be taken not to fall on ground otherwise men/materials will be injured/damaged. iv) See that the anti rotating clamp provided on trolley coincides with alternator suspension pin. v) Replace the worn out alternator and alternator suspension bracket bushes. vi) See that the alternator should not have play with proper washers in improper place to align the axle pulley. vii) Safety chains and cotter pins to be provided without fail.

**26) Give important measures adopted by railways for prevention of fires in TL coaches?**

Ans. a) Cable sizes have been standardized. b) Provision of fuse on both positive and negative side in FDB c) Use of self extinguishing PVC cables. d) Provision of rubber grommets at points where the cable enters through metal members in the coach. e) Proper crimping at the cable terminals. f) Air clearance of 10 mm between live part and earth and between parts of opposite polarity. g) Replacing of cables with any joints, noticed during POH. h) Re-wiring of the coach planned on the basis of cable life of 15 years. i) Use of Flame retardant Insulation tape. j) If I.R. value of wiring is less than 1M, rewiring should be taken up.

**27) What precautions will you take during re-wiring of a coach?**

Ans. a) Use of PVC cables of suitable current. b) In under frame and end walls of coach the wiring has to be drawn through Rigid steel conduits c) Use of proper size of fuses. d) The phase and field wires from the Alternator to terminal box shall be run in one flexible PVC conduit and from terminal box to rectifier – cum-regulator & from rectifier-cum-regulator to under frame terminal board in one rigid steel conduit. e) Proper method of crimping by using proper die and use of corrosion inhibiting compound during crimping of Aluminium cables. f) Segregation of positive and negative cables. g) Cables in the roof (super structure) to be carried in non-metallic rigid conduits with proper cleating arrangement. h) Use of FRLT insulation tape. i) After re-wiring the test the insulation resistance with 500v dc megger. The minimum insulation resistance should be 2 Mega ohms.

**28) What are the disadvantages of 110 Volts DC Train lighting System?**

Ans: Disadvantages: a) In the 120 volts system single battery is provided load on the battery is more. The life of the battery is reduced considerably. b) Due to introduction of transform mounting system the complete coach has to be lifted for replacement of V belts. c) Due to provision smaller size batteries, the quantity of electrolyte is limited. If the level of electrolyte is not maintained by adding distilled water, the batteries may damage. d) Due to high voltage system, requires high value of insulation resistance for safety etc.

**29) What are the major train lighting equipments available in Self Generating coaches?**

Ans. The major train lighting equipments in coach are a) Alternator b) Rectifier cum Regulator Unit c) Battery d) Axle Pulley e) Rotary/ Roof Junction Box f) Under frame Junction Box g) Fans h) Lights i) EFT j) BCT

**30) What are the sizes / capacity of fuses provided at various locations of 110 Volts Train Lighting coach?**

Ans. Sl. No. Circuit fuse Location Fuse size Current rating 1. 2. 3. 4. 5. 6. 7. Positive/negative SPM1 & SPM2 Main negative L1, L2, and F +ve Battery fuse Field fuse AC fuse Branch fuses

Junction box Junction box Junction box Battery box Regulator box Regulator box DFB 35  
SWG RW 16A HRC 35A HRC 16A HRC 40A HRC 6A HRC 20 35A HRC 6A --- --- --- --- 6A ---

**31) What was the latest proforma issued by Railway Board for special drive to prevent fire in TL coaches during trip inspection?**

Ans: The latest proforma issued by Railway Board for special drive to prevent fire in TL coaches during trip inspection is given below: Sl. No. Depot Date Train No. Coach No. Earth Leakage (Y/N) Incorrect rating of HRC fuses (Y/ N) Rewire able fuses replaced with HRC fuses (Y/N) Availability of OVP in RRU/ERRU (Y/N) Condition of FDBs (Y/N) Loose wires & connections (Y/N) Remarks

**32) Explain Trickle Charging of Batteries?**

Ans: When a battery is kept as an emergency reserve, it is very essential that it should be found fully charged when an emergency arises. Due to leakage action and open circuit losses, the batteries deteriorate. Hence to keep it fresh, batteries are kept on a small charging. For example: A standby battery for station bus-bar of 400 Ah at 10 hr rating, a continuous trickle charge of 1 Amp will keep the cells fully charged and keep in perfect condition

**32) Why earthing is necessary for any electrical equipments, domestic installation & service building etc?**

Ans: To drain away any leakage of currents due to poor insulation and to save human life from dangerous shock and also to avoid burnt of electrical equipment.

**33) What are Different type of earth conductor and sizes?**

Ans: a) Copper plate electrode Minimum 60 cm X 60 cm X 3.15 mm b) Galvanized iron & steel plate electrode 60 cm X 60 cm X 6.3 mm c) G.I. Pipe electrode internal diameter 50 mm and length 2.5 Mtrs

**34) Action to be taken if the resistance to earth of earth electrode is high?**

Ans: Earth resistance depends upon soil conductivity. To reduce earth resistance dig around the earth electrode, clean all the rust around earth plate or pipe. Sprinkle the common salt dissolved water in the pit and pack it up with powdered coke & salt. If it is not possible provide additional earths and connects all the earth points in parallel by solid jumper connections.

**35) What happens if electrical connection or electrical joint is loose?**

Ans: due to loose connection at joints resistance at that point will increase thereby the  $I^2R$  losses are more and develops heat. The total wiring may burn.

**36) Explain how to use Fire extinguisher practically?**

Ans: a) Pull the pin at the top of the extinguisher. b) Aim the nozzle towards the base of the fire. c) Stand approximately 8 feet away from the fire and squeeze the handle to discharge the extinguisher. d) Sweep the nozzle back and forth at the base of the fire.

**37) What are the precautions to be taken before starting work on electrical installations?**

Ans: Before starting any electrical works on installations disconnect the power supply to the Electrical equipment and discharge & connect earth. Test with meters for any availability of supply then start the work.

**38) Function of circuit – breaker, difference between 'isolator' and circuit breaker?**

Ans: The function of circuit breaker is to break the electrical continuity in the event of faults duly isolating the faulty part. Isolator is switching device, which operates in OFF load only. Circuit Breaker is switching device, which can operate in, OFF or ON load.

**39) If a feeder circuit-breaker trips, what action is required?**

Ans: First isolate the faulty feeder check the faulty area on which fault the breaker was tripped (short circuit, open circuit and earth fault) after attending the faults test for its continuity and take insulation resistance of the feeder by using megger. And take the feeder into circuit.

**40) Different types of low-tension fuses and high-tension fuses?**

Ans: There are two types of fuses they are a) L.V Fuses - 1) Semi enclosed re-wirable fuses - 2) HRC cartridge fuses. b) H.V Fuses - 1) High voltage HRC fuses - 2) Liquid type

**41) Precautions to be taken in carrying out repairs on LT and HT switch gear?**

Ans: The following precautions to be taken in carrying out repairs on LT & HT switch gears.

a) Disconnect the power supply. b) Discharge the lines by connecting earth. c) Short the three phases with chain d) Start the work to carryout the repairs.

**42) How do you measure the insulation resistance of transformer and what should be the minimum value?**

Ans; The insulation resistance of the transformer can be measured by using Megger and the minimum value of insulation resistance is 50 mega Ohm's.

**43) Conditions for connecting two transformers in parallel?**

Ans: a) Per unit impedance should be same b) Voltage rating should be same c) Phase sequence should be same.

**44) What is the function of CT & P.T and where they are used?**

Ans: The full form of CT is Current transformer and is used for measuring of current. The full form of PT is Potential transformer and is used to measure voltage.

**45) Explain how to replace the HT Fuse on a 4-pole or 6-pole structure?**

Ans: a) Open switch on 4-pole or 6-pole. b) Connect the discharge rod between conductor and earth. c) Replace the blown HT fuse.

**46) What is the safety items kept in Sub-Station?**

Ans: a) Discharge rod b) Pair of gloves c) Sand buckets d) Fire extinguishers. e) Safety belts and helmets f) 3 phase shortening chains

**47) What are the Duties of Sub-Station Operator?**

Ans: Sub station operator is responsible for proper and safe operation of all electrical equipments in sub-station. He should write the hourly reading in log book. He should note any unusual occurrences. He should able to operate fire extinguisher in case of emergency. He should keep all tools, safety belts, testing equipments, etc., in good condition.

**48) Describe procedure to take shut down and to test the power line before starting work?**

Ans: Study the circuit and identify the circuit breaker to be opened. Open and lock the circuit breaker and keep the key in personnel custody. Disconnect neutral link if available. Hang "Man at Work" notice board on the circuit breaker. Test for supply after making sure that, the testing device itself is OK at the equipment or line. Start the work

**49) What are the types of Motors?**

Ans: According the current there are two types of motors QUESTION a) AC motors - 1) single-phase AC motors - 2) 3-phase AC motors. b) DC motors- 1) shunt motors - 2) Series motors - 3) Compound motors.

**50) What are the different types of starters?**

Ans; a) DOL starter b) Star - Delta starter c) Auto transformer starter d) Rheo-static starter

**51) How do you change the direction of rotation of a D.C. motor?**

Ans: The direction of rotation of DC motor can be changed either by changing the field winding connections or by changing the armature winding connection.

**52) Cause of sparking at the brushes of a DC Motor?**

Ans: Sparking at the brushes may be occur due to poor quality of carbon brushes, poor armature, loose connection of carbon brush holder and loose spring tension.

**53) How do you change the direction of rotation of 1 $\phi$  AC motor & 3 $\phi$  AC motor?**

Ans: The direction of rotation of single-phase AC motor is changed by changing the capacitor connections from starting winding to running winding and vice versa. The direction of rotation of three-phase AC motor is changed by changing the phase sequence of three-phase supply.

**54) What is a CLS panel? Briefly explain its functioning?**

Ans: A CLS (Colour Light Signaling) panel is a power control unit which primarily extends the power supply to signaling system. The CLS panel is provided in Electrified section of Railway line, where power supply from 25KV OHE which is most reliable is tapped and stepped down by auxiliary transformers to 230V AC single phase. The power supply thus obtained from UP/DN OHE lines and also the local power supply is fed to CLS panel, which automatically/manually senses the healthy power and feeds to the signaling system.

**55) What is power factor? List the disadvantages of lower power factor? How to improve power factor? Mention the formula for required KVAR to improve power factor?**

Ans: The ratio of useful power (KW) to apparent power (KVA) is termed as power factor. The power factor indicates the portion of the current in the system performing useful work. The power factor of Unity denotes 100% utilization of the total current. The disadvantages of lower power factors are: (i) Over loading of cables & transformers. (ii) Drop in voltage at load points. (iii) In-efficient operation of plants and (iv) Attraction of penalty from power supplies companies. The best way of improving power factor by installing suitable rating static power capacitors preferably at load points.  $kVAR = kW (\tan\phi_1 - \tan\phi_2)$

**56) What is the objective of Indian Electricity Act-2013?**

Ans: The main objectives of Indian Electricity Act-2013 are: (i) To consolidate the laws relating to generation, transmission, distribution, trading and use of electricity. (ii) Taking measures to conducive to development of electric industry and promoting competition. Therein, protecting interests of consumers including supply of electricity to all areas. (iii) Rationalization of electricity tariff, ensuring transparent policies regarding subsidies. (iv) Promotion of efficient and environmentally being policies. (v) Constitution of central electricity authority regulatory commission and establishment of appellate tribunal.

**57) What are the illumination levels to be maintained at A1, A & B stations?**

Ans: S.No Location Approved Lux Levels for different category of stations  
Category of Station A1/A B/C  
1 Concourse 150 /100/ 20  
Circulating Area 50 /30/ 30  
Waiting Hall 150/ 100/ 40  
Retiring Room 100/ 100/50  
Platform a. Open 50 /30/30 b. Covered 150/ 100/60  
Enquiry cum Reservation office. a. General 150/ 100/60 b. Counter 150/ 150/ 70  
Covered Passenger Way a. Corridors 50/50 b.FOB 50/ 50 c. Stairs 50 /50  
8 Parcel/luggage office a. General 100/100 b. Counter 150/150/90  
Timer Table 200/200/100  
Outdoor car parking 50/30/10  
Restaurant Area a. Kitchen 200/150 b. Stores 150/100 c. Dining Hall 200/ 150/120  
Other Service building at Station 200/200/130  
Cloak Room a. General 100/100 b. Counter 150/ 150/140  
Public Utility Services (Toilet/Bathroom) 100/75

**58) What are the essential equipments to be maintained in ART & MRV?**

Ans: Electrical equipments in ART/MRV available as per Railway Board's Lr.

No.99/Elec/G/113/1, dtd.16-07-03. S. No. Equipment Proposed to be Modified ARTs (Class A/Class B) ARMEs (class C) 1 Diesel generating set of 15 KVA 230 V Capacity \* 1 Set -- 2 Generator set Kerosene driven 1.5 KVA 230 V. 20Sets 2 sets 3 Complete lumina fitting with 1000 W Halogen lamps and control gear 10Sets 2 sets 4 Complete lumina fitting with 150 W Metal Halide lamp and control gear 40Sets 10 sets 5 Telescopic stand 2 Mts high for mounting luminars for Halogen/MH fittings. 20 Nos -- 6 PVC insulated and PVC sheathed 3 Core flexible cables 23/0.193 mm 15 m long with 15 weather proof IC pin for weather proof I.C. socket. 50 nos 12 nos 7 PVC insulated and PVC sheathed 3 Core flexible cable 23/0.193 mm 1500 mtrs 300 mtrs 8 K. Oil in 200 Lts capacity drums. 3 nos 1 no 9 Diesel oil in 200 Lts drums 1 no -- 10 Polythene containers 20 Lts capacity for handling kerosene and pouring into auxiliary tanks of engine 18 nos 4 nos 11 Lubricating Oil 40 ltrs 5 ltrs 12 Oil measuring can 1 Litre capacity 6 nos 1 no 13 Insulation tape PVC in rolls of 10 mts. 24 nos 6 nos 14 Tool set comprising of 1 no. cutting plier (254 mm), 3 no's of screw driver (round of 300 mm, 150 mm & 100 mm), 1 no. Knife and 1 no. hammer DP. 1 set 1 set 15 Spanner DE 3m to 19mm in steps of 1.5mm 1 set 1 set 16 Socket spanner with lever 3 mm to 19 mm 1 set 1 set 17 Aluminum telescopic ladder 2 nos -- 18 Earthing rod for earthing OHE \*\* 2 nos -- 19 Portable switch board with water proof sockets each capable of taking 500 watt load (2 sockets of 5 Amps and 2 combination sockets of 5/15 amps) 4 sets 1 set 20 Drum of fixed stand for main cable 2 nos -- 21 Battery charger 230 V AC/110 DC , 60 Amps 2 nos -- 22 100 W Gas filled bulbs bayonet type along with holder in wire cage and with handle and hook 6 nos 4 nos 23 Telescopic masts 6 meters high 4 nos 2 nos Note: - To avoid premature replacement of existing 6 KVA D.G. set, the existing 6KVA DG set should only be replaced by 15 KVA D.G. set when it is due for replacement. All new ART's shall be equipped with 15 KVA D.G. set. \*\* To be provided on Electrified Section only.

59) **If a single phase motor fails to start or run slow what action to be taken.**

Ans: If it is not starting check the supply and test the winding if it found normal check capacitor.

60) **Will a three-phase motor continue to run even if the fuse on one-phase is blown?**

Ans: Yes it will be run but the motor will be getting heated up and chances of motor winding may be burnt.

61) **During run if a motor is getting unduly hot, what should be the reason?**

Ans: The motor may be overloaded or bearing may be defective.

VII. **PROBLEMS:**

1) **An inductive circuit has a resistance of 2.0 Ohms in series with an inductance of 0.015 henry? Find (a) Current (b) power Factor (c) Power consumed? When connected across 200 Volts, 50 Hz. Supply mains?**

Ans Given data  $R = 2.0 \text{ Ohms}$  ,  $L = 0.015 \text{ H}$  ,  $V = 200\text{V}$  ,  $f = 50 \text{ Hz}$ . Formula used  $Z = \sqrt{R^2 + X_L^2}$   $X_L = 2\pi f L = 2 \times 22/7 \times 50 \times 0.015 = 4.714 \text{ Ohms}$ .  $Z = \sqrt{(2)^2 + (4.714)^2} = \sqrt{26.22} = 5.121 \text{ Ohms}$ . (a)  $I = V/Z = 200/5.121 = 39.05 \text{ Amps}$ . (b) Power Factor =  $R/Z = 2/5.121 = 0.39$  (c) Power Consumed  $P = VI \cos\phi = 200 \times 39.05 \times 0.39 = 3045.9 \text{ Watts}$ .

2) **Calculate the Line and Phase current of AC, 3 phase, 400 Volts, 7.5 B.H.P.? Motor with a power factor of 0.8 and efficiency 90%, when the winding is connected (a) in star (b) in Delta?**

Ans Given Data VL = 400 Volts , 3 Phase BHP = 7.5, P.F = 0.8  $\eta$  = 90% Formula used -  
 Efficiency  $\eta$  = Output/Input or Input = Output/  $\eta$  Power P =  $\sqrt{3}$  VL IL Cos $\phi$  BHP = 7.5 x 746  
 Watts. = 5595 Watts. Input (P) = Output/  $\eta$  = 5595 / 0.9 P = 6216.66 Watts. P =  $\sqrt{3}$  VL IL Cos $\phi$   
 6226.66 =  $\sqrt{3}$  x 400 x IL X 0.8 IL = 6216.66 /  $\sqrt{3}$  x 400 x 0.8 IL = 11.2 Amps. (a) In star Line  
 current = Phase current Therefore IPh = 11.2 Amps. (b) In Delta Phase current IPh = IL /  $\sqrt{3}$  =  
 11.2 /  $\sqrt{3}$  = 6.4 Amps.

3) **A 250 KVA, 11000/400 Volts Delta / Star 3 phase transformer has load of 100 Amps. Find the line current on primary?**

Ans Given Data Primary Voltage VP = 11000 Volts Secondary Voltage Vs = 440 /  $\sqrt{3}$  (Since star connected) Secondary Voltage Is = 100 Amps. Power = 250,000 VA Formula : Vs/ Is = Ip/ Is  
 440 /  $\sqrt{3}$  = Ip 11,000 400 440 /  $\sqrt{3}$  X 100 = 40 11,000 11 x  $\sqrt{3}$  = 2.09 Amp.

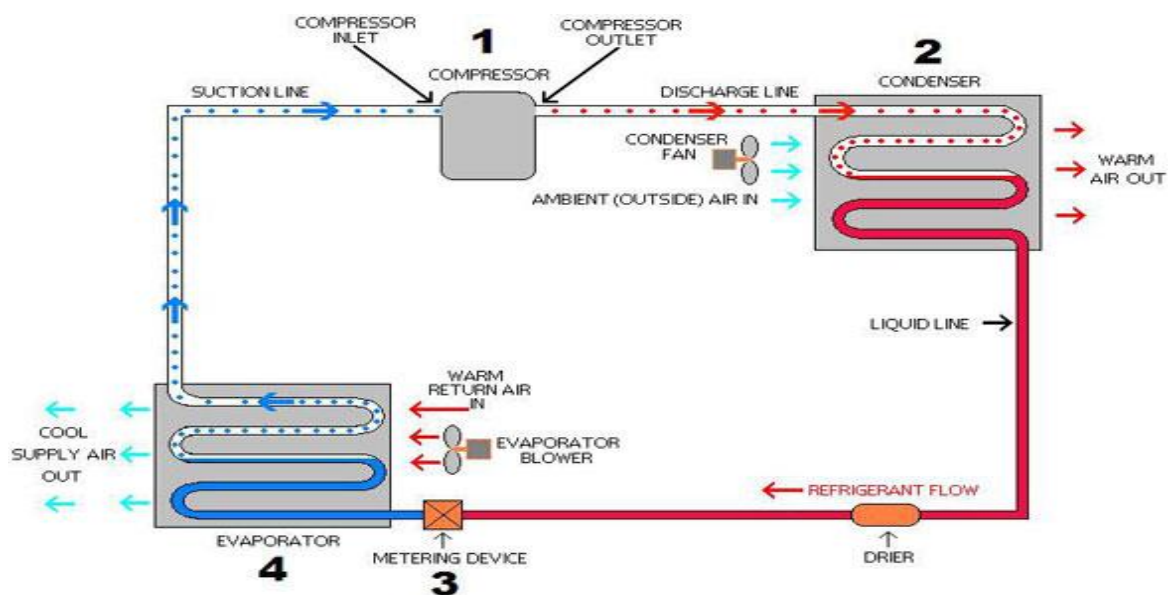
4) **Find the diameter of copper wire in mm, if the resistance of 1.5 Kilometer wire is 7.2 Ohms? (Specific Resistance of copper is  $1.7 \times 10^{-6}$  Ohm/cm<sup>3</sup> )**

Ans Given Data Length = 1.5 Km = 15,000 cm Resistance = 7.2 Ohms.  $\rho$  =  $1.7 \times 10^{-6}$  Ohm/cm<sup>3</sup>  
 We Know  $R = \rho L/a$   $7.2 = 1.7 \times 10^{-6} \times 15,000 / a$   $a = 1.7 / 1,00,000 \times 15,000 / 7.2 = 0.035$  sq.cm.  
 Now  $a = \pi d^2 / 4$   $0.035 = \pi (d)^2 / 4$   $d = \sqrt{0.035 \times 4 / \pi} = 0.21$  cm. 22

5) **Find the capacity of pump (HP) to pump the water at the rate of 20 Gallons per minute, from the bore well of 250 ft. depth to the overhead tank of height 100 ft. Neglect all friction losses. Take specific gravity of the water as '1' and take efficiency of the pumps as 60%?**

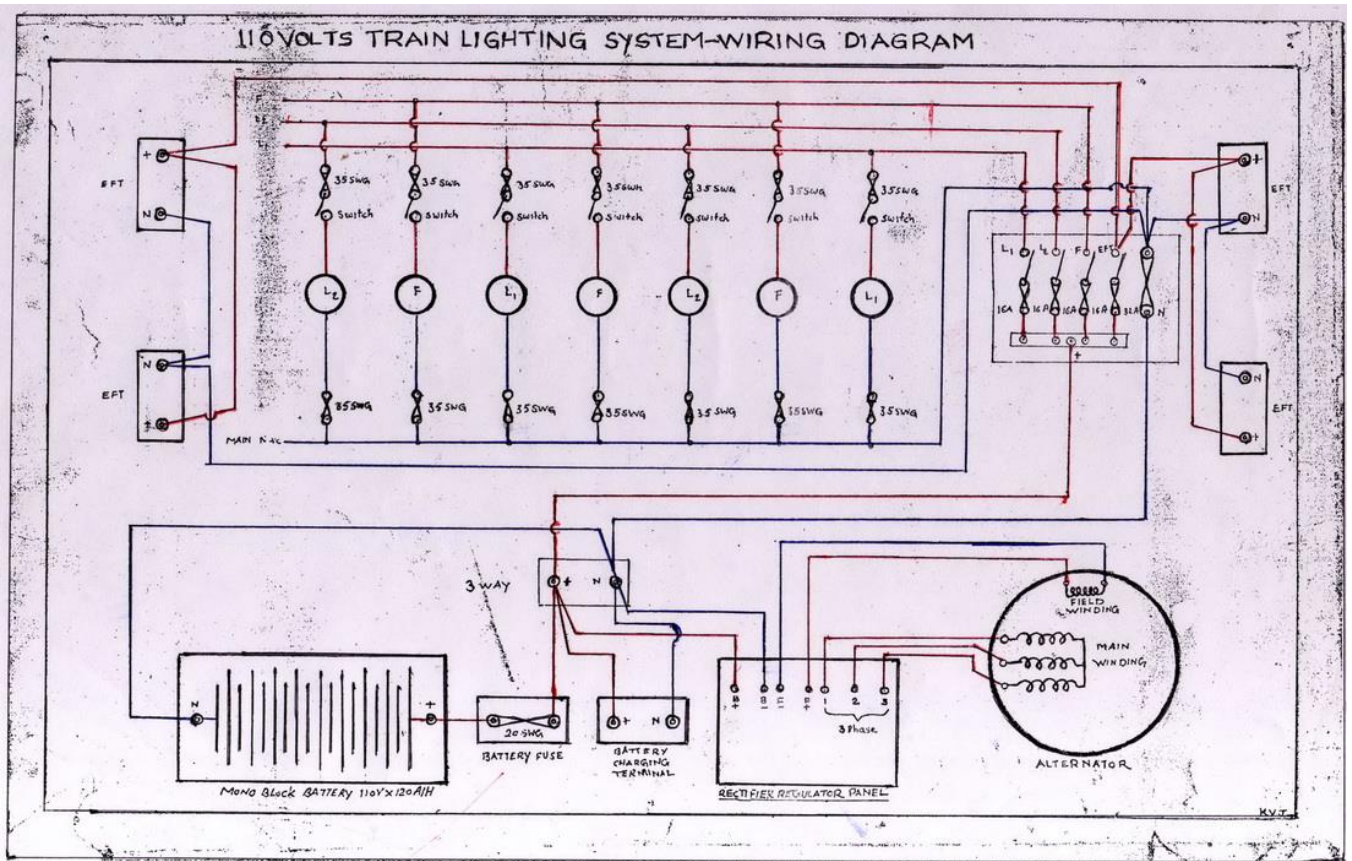
Ans: Given Data Discharge (Q) = 20 Gallons per minutes (GPM) Depth of bore well = 250 ft. Height of the water tank = 100 ft. Specific gravity of water (S.G) = 1.0 Efficiency of the pump ( $\eta$ ) = 60% = 0.6  
 Pump capacity in Horse Power(HP) =  $Q \times \text{Head} \times \text{Specific Gravity} / 3960 \times \eta$   
 Total Head = Depth of bore well + Height of the Tank (in feet) = 250 + 100 = 350 Feet. Pump Capacity in HP =  $Q \times \text{Head} \times \text{Specific Gravity} / 3960 \times \eta = 20 \times 350 \times 1.0 / 3960 \times 0.6$

1. **Draw a schematic diagram for Refrigeration cycle.**



2. **Single line diagram for 110V D.C TL coaches.**





3. Draw a schematic diagram of 6KV/415V Power substation.