Utilization of Electric Power

Module 01 : Electric Traction introduction

Q1. Which of the following is an advantage of electric traction over other methods of traction?

a) Faster acceleration
b) No pollution problems
c) Better braking action
d) All of the above

Q2. Which of the following is the voltage for single phase A.C. system?

a) 22V
b) 440V
c) 5kV
d) 15kV

Q3. Long distance railways use which of the following?

a) 200 V DC
b) 25kV single phase A.C.
c) 25 kV two phase A.C.
d) 25 kV three phase A.C.

Q4. The speed of a locomotive is controlled by

a) Flywheel
b) Gear box
c) Applying brakes
d) Regulating steam flow to engine

Q5. Main traction systems used in India are, those using

a) Electric locomotives
b) Diesel engine locomotives
c) Steam engine locomotives
d) Diesel electric locomotives
e) All of the above

Q6. In India diesel locomotives are manufactured at

a) Ajmer
b) Varanasi
c) Bangalore
d) Jamalpur

Q7. The value of co-efficient of adhesion will be high when rails are

a) greased

b) wet
c) sprayed with oil
d) cleaned with sand

Q8. Specific energy consumption becomes

a) more on steeper gradient
b) more with high train resistance
c) less if distance between stops is more
d) all of the above

Q9. In main line service as compared to urban and suburban service

a) distance between the stops is more
b) maximum speed reached is high
c) acceleration and retardation rates are low
d) all of the above

Q10. Which method can bring the locomotive to dead stop

a) plugging braking
b) rheostatic braking
c) regenerative braking
d) none of the above

Q11. Explain different types of electric traction systems.

Q12. Select an appropriate electric traction system for any upcoming urban railway system in Darbhanga.(Use local knowledge of the city in determining the number of stops and distances between them)

Q13. Compare the three phase induction motor with dc motor and single phase ac series motor for traction application.

Q14. Derive an expression for tractive effort required by train for propulsion along a gradient.

Q15. Derive an expression for specific energy specific consumption for a train service.

Q16. A 100 tonne electric train has rotational inertia of 10 percent. This train while running between two stations which are 2.5 km apart has an average speed of 50 km/h. the acceleration and retardation during braking are respectively 1 km/h/s and 2 km/h/s. The percentage gradient between these two stations is 1 percent and the train is to move up the incline. The track resistance is 40N/t. If the combined efficiency of the electric train is 65 percent , determine:

i) Total energy output at the driving axles.
ii) Total energy consumption
iii) Specific energy consumption

Q17. Differentiate between trapezoidal and quadrilateral speed time cureves.

Q18. Define the following:

i) Crest speed

ii) Average speed
iii) Scheduled speed

Q19. A 250 tonne motro coach driven by four motors takes 20 seconds to attain a speed of 42 kmph, starting from rest on an ascending gradient of 1 in 80. The gear ratio is 3.5, gear transmission efficiency 92%, wheel diameter 92 cm, train resistance 40N/tonne and roataional inertia 10% of the dead weight. Find the torque developed by each moaor.

Q20. A train service consists of the following:Uniform acceleration of 5kmphps for 30 seconds followed by free running for 10 minutes, then uniform braking at 5kmphps to stop followed by a stop of 5 minutes.

Draw the speed time curve and calculate-

i) Distance between the stations
ii) Average speed
iii) Scheduled speed

Module : 02

Electric Heating

Q1. Which of the following has the highest value of thermal conductivity

a) Copper
b) Aluminium
c) Brass
d) Steel

Q2. Which of the following heating methods has maximum power factor?

a) Arc heating
b) Dielectric heating
c) Induction heating
d) Resistance heating

Q3. Which method is used for heating non-conducting materials

a) Eddy current heating
b) Arc heating
c) Induction heating
d) Dielectric heating

Q4. Which of the following methods of heating is not dependent on the frequency of supply?

a) Induction heating
b) Dielectric heating
c) Electric resistance heating
d) All of the above

Q5. When a body reflects entire radiation incident on it, then it is known as:

a) White body
b) Grey body
c) Black body
d) Transparent body

Q6. Induction heating process is based on which of the following principles?

a) Thermal ion release principle
b) Nucleate heating principle
c) Resistance heating principle
d) Electro-magnetic induction principle

Q7.

Which of the following insulating materials is suitable for low temperature applications ?

(a) Asbestos paper **(b) Diatomaceous earth**

(c) 80 percent magnesia **(d) Cork.**

Q8.

Which of the following will happen if the thickness of refractory wall of furnace is increased ?

(a) Heat loss through furnace wall will increase **(b) Temperature inside the furnace will fall**

(c) Temperature on the outer surface of furnace walls will drop

(d) Energy consumption will increase.

Q9.

By the use of which of the following, high frequency power supply for induction furnaces can be obtained ?

(a) Coreless transformers **(b) Current transformers**

(c) Motor-generator set **(d) Multi-phase transformer.**

Q10.

In an electric room heat convector the method of heating used is

(a) arc heating **(b) resistance heating** **(c) induction heating** **(d) dielectric heating.**

Q11. A 27 kW, 3-phase ,400 V resistance oven is to employ nickel-chrome strip 0.25 mm thick for the three star -connected heating elements. If the temperature of the strip is to be 1000^0C and that of the charge be 600 ^{0}C estimate a suitable width for the strip. Assume emissivity =0.9 and radiating efficiency to be 0.5 and resistivity of the strip material is $101.6*10^{-8}$ ohm-meter.

Q12.

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The following data relate to a 4-phase electric arc furnace :

Current drawn = *4000 A*

Arc voltage = *60 V*

Resistance of transformer referred to secondary = *0.0025 Ω*

Reactance of transformer referred to secondary = *0.0050 Ω*

(i) Calculate the power factor and kW drawn from the supply.

(ii) If the overall efficiency of the furnace is 70 percent, find the time required to melt 2.5 tonnes of steel if latent heat of steel = 37.2 kJ/kg, specific heat of steel = 0.5 kJ/kg K, melting point of steel = 1370° C and initial temperature of steel = 15°C.

Q13.

If a 3-phase arc furnace is to melt 10 tonnes of steel in 2 hours, estimate the average input to the furnace, if overall efficiency is 50 percent. If the current input is 9000 A with the above kW input and the resistance and reactance of furnace leads (including transformer) are 0.003 Ω and 0.005 Ω respectively, estimate the arc voltage and total kVA taken from the supply.

Specific heat of steel = 0.444 kJ/kg°C ;

Latent heat of fusion of steel = 37.25 kJ/kg

Melting point of steel = 1370°C.

Assume initial temperature of steel = 20°C.

Q14.

Calculate the efficiency of a high frequency induction furnace which takes 10 minutes to melt 1.8 kg of aluminium. The input to the furnace being 4.8 kW and initial temperature 15°C. Specific heat of aluminium = 0.88 kJ/kg°C ; melting point of aluminium = 660°C ; latent heat of fusion of aluminium = 32 kJ/kg ; 1 kJ = 2.78 × 10^{-4} kWh.

Q15.

A low frequency induction furnace operating at 12 V in secondary circuit takes 480 kW at 0.5 p.f. when hearth is full. If the secondary voltage be maintained at 12 V, estimate the power factor and the power absorbed when hearth is half-full. Assume the resistance of the secondary circuit to be thereby halved and the reactance to remain the same.

Q16.

In the case hardening of a steel pulley, the depth of penetration required is 1.4 mm. The relative permeability is unity and the specific resistivity of steel is 5×10^{-7} Ω m Determine the frequency required.

Q17.

A slab of insulating material 130 cm^2 in area and 1 cm thick is to be heated by dielectric heating. The power required is 380 W at 30 MHz. Material has a relative permittivity of 5 and p.f. of 0.05. Absolute permittivity = 8.854×10^{-12} F/m. Determine the necessary voltage.

Q18.

A plywood board 0.5 m × 0.25 m × 0.02 m is to be heated from 15°C to 135°C in 10 minutes by dielectric heating employing a frequency of 30 MHz. Determine the power required in the heating process. Assume specific heat of wood 1500 J/kg °C ; weight of wood 600 kg/m^3 and efficiency of process 55 percent.

Q19. Describe the frequency used for different types of heating.

Q20. Compare induction and dielectric heating.

Module -03

Cooling

1-During combustion in the engine, temperature in the cylinder raises up to
(A) 1500°C

(B) 1700°C

(C) 2700°C

(D) 3700°C

2-In an Internal Combustion engine, about ____ of the latent heat produced during combustion passes through the cylinder wall into the cooling system.
(A) 10%

(B) 20%

(C) 30%

(D) 40%

3-In motorcycles, the following type of cooling system is used
(A) Air cooling system

(B) Water cooling system

(C) Both (A) and (B)

(D) None of the above

4-In water cooling, the water in the jackets obtains heat from the cylinders due to
(A) Conduction

(B) Convection

(C) Radiation

(D) All of the above

5-The thermostatic valves opens and provides passage for the flow of water towards the radiator at approximately
(A) 90° C

(B) 150° C

(C) 250° C

(D) 300° C

6-In thermosyphon system there is (are)
(A) no pump

(B) one pump

(C) two pumps

(D) three pumps

7-In water cooling system with pump circulation system, the following pump is used
(A) Centrifugal pump

(B) Reciprocating type

(C) Rotary vane pump

(D) Any of the above

8-The radiator is usually made of
(A) Aluminium

(B) Copper

(C) Galvanised iron

(D) Stainless steel

9-The following type of core of a radiator contains a large number of individual air cells which are surrounded by water
(A) Tubular type

(B) Gilled type

(C) Honeycomb

(D) All of the above

10-In ____ radiator, each tube contains individual fins surrounding it.
(A) Tubular type

(B) Gilled type

(C) Honeycomb

(D) All of the above

Q11. Explain hydrogen cooling system in heavy machines.

Q12. Compare forced cooling and natural cooling in electric machines.

Q13. How oil cooling is employed in various machines, explain with neat diagram.

Q14. Which cooling method is considered to be the best for high performance laptops.

Q15. Select a proper cooling method for small machines.

Module -04

Electric Welding

1) The electrodes used for projection welding are

a. Flat and smaller in diameter
b. Flat and larger in diameter
c. Round and smaller in diameter
d. Round and larger in diameter

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2) Spot welding is used to weld metal pieces whose thickness

a. Should be greater than 12 mm
b. Lesser than 12 mm
c. Lies between 15 to 20 mm
d. Greater than 20 mm

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3) In percussion welding, the heat is produced by a rapid discharge of stored electrical energy from

a. Capacitor
b. Inductor
c. Resistor
d. Transformer

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4) Seam welding is not used for the

a. Welding in tanks
b. Welding in transformers
c. Welding in air crafts
d. Welding alloys of copper

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5) Voltage required for butt welding is

a. 2 to 8 V
b. 8 to 15 V
c. 15 to 22 V
d. 22 to 30 V

6) For welding aluminium alloys, the electrodes used are

a. Hard drawn copper
b. Cadmium copper
c. Chromium copper
d. Tungsten copper

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7) The heat required by the weld is produced due to the contact resistance between the two pieces and

a. Directly proportional to the current
b. Directly proportional to the square of the current
c. Inversely proportional to the square of the current
d. Inversely proportional to the current

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8) The fusion welding is also known as

a. Plastic welding
b. Pressure welding
c. Non - pressure welding
d. None of these

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9) The example of plastic welding is

a. Resistance welding
b. Gas welding
c. Arc welding
d. Thermit welding without pressure

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10) After welding, the welded parts retain which properties of the metal?

a. Melting point
b. Density
c. Thermal conductivity
d. All of these

Q11. Compare different methods of welding according to their application.

Q12. Describe arc welding with neat diagram.

Q13. Describe resistance welding and compare it with other types of weldings.

Q14. Explain advantage and disadvantage of laser beam welding.

Q15. How can we select electrode material for a particular type of welding.

Q16. Describes various types of joints for weldings.

Module 05

Illumination

1. Radiant efficiency of the luminous source depends on

(A) shape of the source

(B) temperature of the source

(C) wavelength of light rays

(D) all of the above.

2. Light waves travel with a velocity of

(A) 3×10^{10}cm/s

(B) 3×10^{12}cm/s

(C) 3×10^{15} cm/s

(D) 3×10^{18} cm/s.

3. Carbon arc lamps are commonly used in

(A) domestic lighting

(B) street lighting

(C) cinema projectors

(D) photography.

4. The unit of solid angle is

(A) solid angle

(B) radian

(C) steradian

(D) candela.

5. Candela is the unit of

(A) Luminous flux

(B) Luminous intensity

(C) Wavelength

(D) None of the above.

6. The unit of luminous flux is

(A) steradian

(B) candela

(C) lumen

(D) lux.

7. The illumination is directly proportional to the cosine of the angle made by the normal to the illuminated surface with the direction of the incident flux. Above statement is associated with

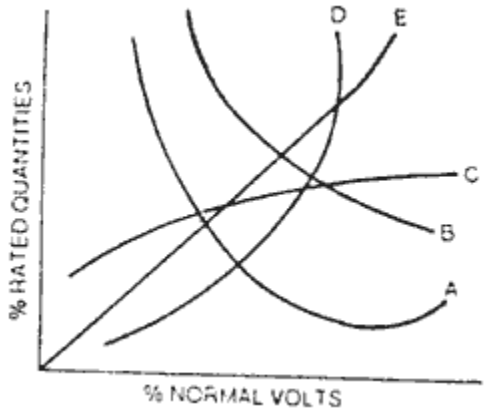
(A) Planck's law

(B) Macbeth's law of illumination

(C) Bunsen's law of illumination

(D) Lambert's cosine law.

8. Which curve represents life of the lamp ?



(A) curve A

(B) curve B

(C) curve C

(D) curve D.

9. Illumination level required for precision work is around

(A) 50 lm/m^2

(B) 100 lm/m^2

(C) 200 lm/m^2

(D) 500 lm/m^2.

10. Which of the following will need the highest level of illumination ?

(A) Proof reading

(B) Bed rooms

(C) Hospital wards

(D) Railway platforms.

Q11.

A lamp with reflector is mounted 10 m above the centre of a circular area of 20 m diameter. If the combination of the lamp and reflector gives a uniform C.P. of 800 over the circular area, determine the maximum and minimum illumination produced on the area.

Q12.

A lamp having a uniform C.P. of 300 in all directions is provided with a reflector which directs 60 per cent of the total light uniformly on to a circular area of 12 m diameter. The lamp is 5 m above the area. Calculate :

(i) The illumination at the centre and edge of the surface with and without reflector.

(ii) The average illumination over the area without the reflector.

Q13.

The illumination at a point on a working plane directly below the lamp is to be 80 lumens / m^2. The lamp gives 180 C.P. uniformly below the horizontal plane. Determine :

(i) The height at which the lamp is suspended.

(ii) The illumination at a point on the working plane 1.5 m away from the vertical axis of the lamp.

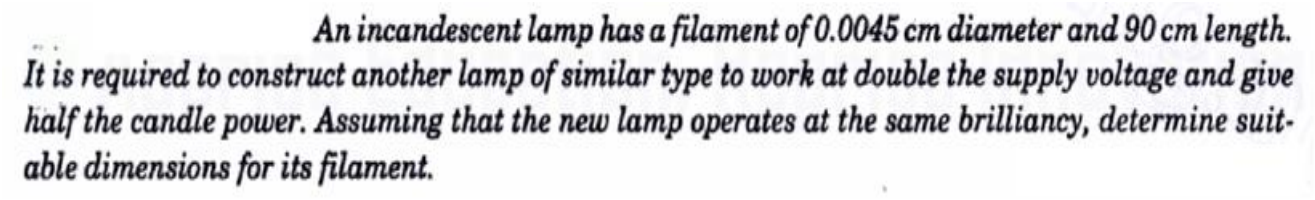
Q14.

A light is placed 4.5 m above ground and its candle power is 200 cos θ in any downward direction making an angle θ with the vertical. If A and B are two points on the ground, A being vertically under the light and the distance AB being 4.5 m, calculate :

(i) The illumination of the ground at A and also at B.

(ii) The total radiations sent down by the lamp.

Q15.


An incandescent lamp has a filament of 0.0045 cm diameter and 90 cm length. It is required to construct another lamp of similar type to work at double the supply voltage and give half the candle power. Assuming that the new lamp operates at the same brilliancy, determine suitable dimensions for its filament.

Q16. Differentiate between direct and indirect and semidirect and semi indirect lighting.

Q17. Explain working of mercury vapour lamp with neat diagram.

Q18. Explain working of CFL.

Q19. What is fluorescence?

Q20. Explain light. Give the electromagnetic spectrum with mentioning visible region and different colors corresponding to different wavelength.

Module 06

Estimation and Coasting of Electrical Installation

1) What is an electrical schedule?

a. A list or a plan of a building providing information of number of points in each room.
b. The list of all the electrical components required for a particular room
c. The list of electrical components along with their prices'
d. Both (B) and (C)
e. None of these

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2) Which among the following information is required for a good estimation?

i. Availability of products
ii. Sources of production, vendor selection
iii. New products and their quality
iv. Prices and the discounts provided for each product

a. i and ii
b. ii, iii and iv

c. i, ii, iii and iv
d. only iv

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3) What is meant by contingencies?

a. The list of required components are included in this category
b. The list of vague and unforeseen items is included in this category
c. The list of components along with their discounted price is included in this category
d. Both (A) and (C)
e. None of these

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4) Which among the following mode of tendering is used by purchase department?

i. Open tendering
ii. Limited tender
iii. Spot tendering
iv. Global tendering
v. Proprietary tender

a. i, iii and iv
b. i, ii, iii and v
c. i and iv only
d. i, ii, iii, iv and v

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5) What is meant by petty purchase?

a. An item purchased from market by purchase assistant with proper formal order.
b. An item purchased from market by purchase assistant without proper formal order.
c. A single tendering purchase
d. None of these

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6) What is the maximum number of lighting points that can be connected in a circuit?

a. 5
b. 10
c. 8
d. 12

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7) What is the maximum load that can be connected in a circuit connecting only lighting points?

a. 500 watts
b. 750 watts
c. 800 watts
d. 1000 watts

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8) Which among these is a method of wiring?

a. Joint box
b. Tee system
c. Loop in system
d. Only a and c
e. All of these

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9) For what voltage levels are the screwed conduit circuits used?

a. Less than 250 V
b. For voltages between 250 V – 600 V
c. For voltages above 600 V
d. None of these

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10) Which material is used for wiring continuous bus bar?

a. Aluminium
b. Copper

c. Both (A) and (B)

d. None of these

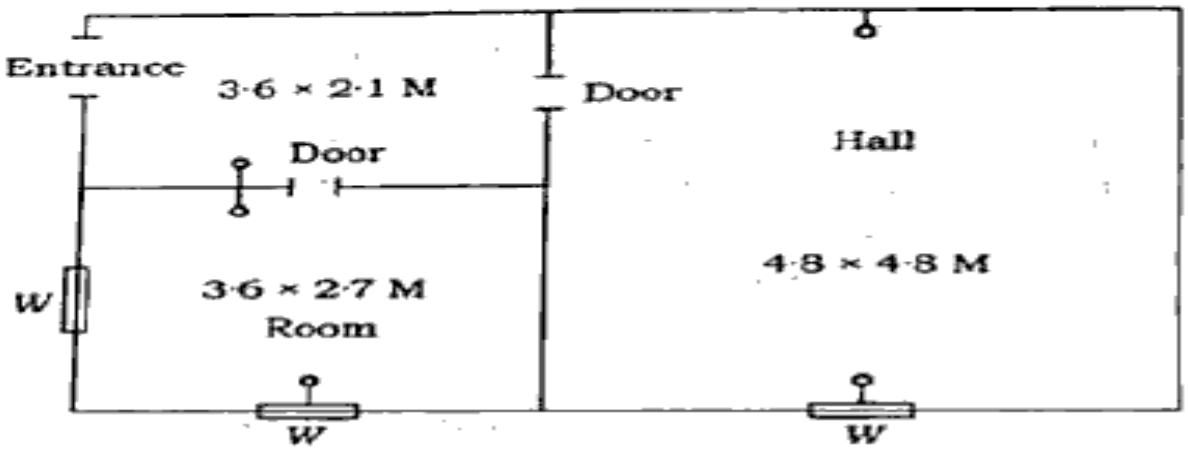
Q11. Explain different types of earthing based on different application.

Q12. List all the steps involved in estimating domestic house wiring.

Q13. How to select materials used in domestic house wiring.

Q14.

Draw the electrical circuit for PVC casing-capping used in a house, the plan of which is given in the figure. Assume the height of ceiling as 3·6 meter and one plug point is to be provided in each room :



Q15.

A bungalow is having 06 rooms, 04 attached lat.-bathrooms, 01 storeroom, 02 kitchens, 01 lobby, 01 corridor, 01 lawn. All stated places are equipped with 01 light source of 40 W each. All rooms are fitted with 01 fan of 80 W each. 02 rooms are fitted with ACs, 2 kW each. 01 television of 70 W in living room. 01 freeze of 200 W average load. 01 iron of 800 W. 02 bathrooms with geysers of 1000 W each. With no other fittings, assuming all loads to be on 24/7 except iron which works 4 hours in all in a week. Calculate the monthly energy consumption. Also calculate the monthly bill if 1 electric unit costs ₹5.

Q16. Explain the problem of unit commitment in power systems.

Q17. Explain how domestic house wiring is different as compared to workshop wiring.

Q18. What are different types of wirings? Explain with application.

Q19. Describe standards used in India for electrical installation and wiring.

Q20. Explain bidirectional energy meter and how it can make electric system more efficient.