



# CBGS SCHEME

17EE742

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Seventh Semester B.E. Degree Examination, Feb./Mar. 2022

## Utilization of Electrical Power

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- With a neat sketch, explain the working of a Indirect Resistance Heating. (06 Marks)
  - A piece of an insulating material is to be heated by dielectric heating. The size of the piece is  $10 \times 10 \times 3$  cm. A frequency of 20 megacycles is used and the power absorbed is 400 W. Calculate the voltage necessary for heating and the current that follows in the material. The material has a relative permittivity of 5 and a power factor of 0.05. (08 Marks)
  - What is Resistance Welding? With a neat diagram, explain flash Butt Welding. (06 Marks)

OR

- Write a note on resistance ovens. Discuss on control equipment for resistance ovens. (06 Marks)
  - A 15 KW, 220 V, single phase resistance oven employs nickel chrome wire for its heating elements. If the wire temperature is not to exceed  $1000^{\circ}\text{C}$  and the temperature of the charges is to be  $600^{\circ}\text{C}$ , calculate the diameter and length of the wire. Assume radiating efficiency as 0.6 and emissivity as 0.9. Assume circular element.  $\rho = 1.016 \times 10^{-6} \Omega\text{-m}$  (08 Marks)
  - State and explain Faradays laws of electrolysis. Also explain:  
(i) Electrochemical equivalent (ii) Current efficiency (iii) Energy efficiency (06 Marks)

### Module-2

- Define the following terms:  
(i) Illumination (ii) Luminous efficiency (iii) MSCP  
(iv) Depreciation factor (v) Space-height ratio (10 Marks)
  - A hall of 27.75 m by 45.75 m is illuminated by indirect lighting employing inverted bowl fittings. An average illumination of 108 lumens per sq.m is to be provided on a horizontal plane parallel to the floor and 0.75 m above it. The walls and ceilings are brightly painted. Design a suitable scheme of illumination using filament lamps. Take coefficient of utilization as 0.35 maintainance factor as 0.9. If instead of indirect lighting 80 Watt fluorescent lamps are used, what would be the saving in power? Assume luminous  $\eta_e$  for 100 Watt lamp = 13.4 lumens/Watt,  $\eta_e$  for 200 Watt lamp = 14.4, and for 80 Watt lamp = 30 lumens/watt. (10 Marks)

OR

- What is photometry? Explain Lummer-Brodhun photometer head. (08 Marks)
  - A lamp of 500 W having MSCP of 1000 is suspended 2.7 mts above working plane. Calculate:  
(i) Illumination directly below the lamp at the working plane.  
(ii) Lamp efficiency  
(iii) Illumination at a point 2.5 mts away on the horizontal plane from vertically below the lamp. (06 Marks)
  - With a neat figure, explain the construction and working principle of sodium vapour discharge lamp. (06 Marks)

**Module-3**

- 5 a. Mention advantages and limitations of electric drives. (06 Marks)  
 b. Assuming a quadrilateral speed time curve, derive equations for (i) total distance travelled by the train between two stops and (ii) velocity at the time of braking. (08 Marks)  
 c. A train is required to run between two-stations 1.0 km apart at a schedule speed of 30 kmph the stopping time is 20 secs. Assume braking retardation 3 kmphs and maximum speed 1.25 times average speed. Determine acceleration required to run the service for a trapezoidal curve. (06 Marks)

**OR**

- 6 a. A 256 tonne motor coach train with 4 motors takes 20 secs to attain a speed of 40.25 kmph starting from rest on a 1 percent up-gradient. The gear ratio is 3.5 and gear efficiency 95%, wheel diameter 91.5 cm, train resistance 44 NW/tonne and rotational inertia 10% of the dead weight. Find the torque developed by each motor. (08 Marks)  
 b. With a neat figure, explain the construction and working of a single phase AC series motor. (06 Marks)  
 c. Explain (i) Shunt transition (ii) Bridge transition applied to series parallel starting of DC motors with figures. (06 Marks)

**Module-4**

- 7 a. Explain: (i) Plugging (ii) Regenerative braking as applied to traction motors. (08 Marks)  
 b. Write a note on mechanical braking. (06 Marks)  
 c. Compare DC and AC systems of railway electrification from the point of mainline and sub urban line railway services. (06 Marks)

**OR**

- 8 a. A 355 tonne train has its speed reduced from 85.5 to 48.3 kmph in travelling 1,525 m down a uniform gradient of 1 in 90. If regenerative braking is used, determine the energy in KWh returned to the line. Take 10% allowance for rotational inertia, 53 Newton/ton for tractive resistance and the overall efficiency as 80%. (08 Marks)  
 b. Explain the function of a negative booster in a tramway system. (06 Marks)  
 c. Sketch and explain the following arrangements of current collection used in electric train:  
 (i) Pantograph collector (ii) Current collecting shoe (06 Marks)

**Module-5**

- 9 a. Explain General Electric Vehicle configuration with block diagram. (06 Marks)  
 b. Discuss the parameters on which performance of electric vehicle depends. (08 Marks)  
 c. Explain the concept of energy consumption of Electric Vehicles. (06 Marks)

**OR**

- 10 a. Explain the concept of Hybrid Electric drive trains. (06 Marks)  
 b. Classify the Hybrid Electric drive trains based on architecture. (08 Marks)  
 c. Write short notes on hybrid drive trains with both torque and speed coupling. (06 Marks)

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