

UTILIZATION OF ELECTRICAL ENERGY**(Electrical and Electronics Engineering)****Time: 3 hours****Max. Marks: 70***Question paper consists of Part-A and Part-B**Answer ALL sub questions from Part-A**Answer any FOUR questions from Part-B************PART-A (14 Marks)**

1. a) List the applications of DC Drives. [2]
- b) List the properties of Good heating element. [3]
- c) Define the following terms:
 - (i) Utilization factor and (ii) Maintenance Factor [2]
- d) Distinguish between Specular reflection and Diffuse reflection. [2]
- e) Explain the significance of Speed – Time curves for train movement. [3]
- f) Distinguish between Coasting period and braking period in Speed – time curve. [2]

PART-B (4x14 = 56 Marks)

2. a) State the important factors on which the selection of Electric Drives depends? [7]
- b) Draw and explain the performance curves of DC Series motor and where they are used? [7]
3. a) List and explain the different methods of Electric Welding in brief. [7]
- b) What is Dielectric heating? Explain the principle of dielectric heating. Give its advantages and Applications. [7]
4. a) Derive the relationship between Solid angle and Plane angle. [7]
- b) The illumination at a point on a working plane directly below the lamp is to be 100 lumens/m². The lamp gives 200 Candle power 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 2 m away from the vertical axis of the lamp. [7]
5. a) Compare between Fluorescent tube and filament lamp. [7]
- b) A hall 30 m long and 15 m wide with a ceiling height of 5 meters is to be provided with a general illumination of 120 lumens/m². Taking a coefficient of utilization of 0.5 and depreciation factor of 1.4, determine the number of fluorescent tubes required, their spacing, mounting height and total wattage. Take luminous efficiency of fluorescent tube as 40 lumens/watt for 80 W tube [7]
6. a) State the advantages of electric traction over other non-electrical systems of traction including steam traction [7]
- b) Explain the following terms :
 - (i) Adhesive Weight (ii) Dead weight (iii) Coefficient of adhesion [7]
7. Write short notes on the following:
 - (a) Mechanics of Train movement
 - (b) Factors affecting energy consumption in propelling a train [14]

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PART-A (14 Marks)

1. a) List the types of motors used for Electric Drive. [2]
- b) Explain the different modes of heat transfer. [3]
- c) Define the following terms:
 - (i) Space height ratio and (ii) Reduction factor [2]
- d) What is Stroboscopic effect and how it can be reduced? [2]
- e) Distinguish between urban, suburban and main line services. [3]
- f) Explain the nature of the traction load. [2]

PART-B (4x14 = 56 Marks)

2. a) Explain how Electric drives are classified and illustrate them with their relative merits and demerits. [7]
- b) Explain the significance of heating and cooling curves of Electrical Machines used in Electric Drives. [7]
3. a) Explain in detail about butt welding and Flash welding. [7]
- b) A resistance oven employing nichrome wire is to be operated from 230 V single phase supply and is to be rated at 20 KW. If the temperature of the element is to be limited to 1150°C and average temperature of the charge is 500°C . Find the diameter and length of the element wire. Assume radiating efficiency = 0.57, Emissivity = 0.9, Specific resistance of nichrome = $109 \times 10^{-8} \Omega \cdot \text{m}$ [7]
4. a) Explain the construction and working of High pressure mercury vapour lamp. [7]
- b) Two lamp posts are 16 m apart and are fitted with 250 Candle Power lamp each at a height of 6 m above the ground. Calculate (i) Illumination mid – way between them. (ii) Illumination under each lamp [7]
5. a) List the main objectives of Street Lighting, and explain how Diffusion and Specular reflection principles are used in the design of street lighting calculations. [7]
- b) Explain in detail about Flood lighting and how projectors are classified based on beam spread? [7]
6. a) Distinguish between Crest Speed, Average speed and Schedule Speed in detail. [7]
- b) A suburban electric train has a maximum speed of 72 KMPH. The schedule speed including a stop of 25 seconds is 45 KMPH. If the acceleration is 1.8 KMPHPS, find the value of retardation when average distance between stops is 4.5 Km? [7]
7. a) Derive the equation for the Power output from the driving Axles. [7]
- b) Distinguish between the terms Energy consumption and Specific Energy [7]

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PART-A (14 Marks)

1. a) What is the nature of intermittent and variable loads? [2]
- b) List the different types of Electrodes used in Arc furnaces. [2]
- c) Define the following terms: [2]
 - (i) Candle power and (ii) Mean Horizontal Candle Power
- d) List the advantages of Incandescent lamps. [3]
- e) Discuss various factors on which final choice of traction depends. [3]
- f) How does the effective mass of a vehicle differ with its physical (actual) mass? [2]

PART-B (4x14 = 56 Marks)

2. a) List the advantages and disadvantages of Electric drive. [7]
- b) A series motor takes 20 A at 400 V to drive a fan at 200 rpm. Its resistance is 1 ohm (field and armature). If the torque required to drive the fan varies as the square of the speed, find the necessary applied voltage and current to drive the fan at 300 rpm. [7]
3. a) Explain the construction and working of Coreless type (or) high frequency induction furnace [7]
- b) Discuss the principle of Arc welding and give the difference between carbon and metallic arc welding and also their relative merits [7]
4. a) What are Polar curves and what is their significance? [7]
- b) 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 Candle Power of 1000 over the circular area, determine the maximum and minimum illumination produced on the area. [7]
5. a) Explain the working of Fluorescent lamp with a neat diagram. [7]
- b) How does an interior lighting design differ from external lighting design? Explain briefly the design procedure in each. [7]
6. a) Explain the typical speed – time curve for electric train operating on passenger services. [7]
- b) Explain the tractive effort for Propulsion of train and on what factors does it depend. [7]
7. a) Derive the equation for the Energy output from the driving Axles. [7]
- b) A goods train weighing 500 tonnes is to be hauled by a locomotive up an ascending gradient of 2 percent with an acceleration of 1 KMPHPS. If the coefficient of adhesion is 0.25, train resistance 40 N/t and effect of rotational inertia 10 percent. Find the weight of locomotive and number of axles if load is

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PART-A (14 Marks)

1. a) State and explain about Electric Drive. [2]
- b) Explain the concept of Induction heating. [3]
- c) Define the following terms: (i) Luminous Flux and (ii) Luminous intensity [2]
- d) List the requirements of Good Lighting. [3]
- e) What do you mean by Electric Traction? [2]
- f) Define the term Specific Energy output. [2]

PART-B (4x14 = 56 Marks)

2. a) What are the different types of loads and Explain how they are categorized? [7]
- b) Explain the term "Load Equalization" and give its significance and its role in Electric drives [7]
3. a) Explain the working of indirect arc furnace with a neat diagram and also give its merits [7]
- b) A slab of insulating material 120 cm² in area and 2 cm thick is to be heated by dielectric heating. The power required is 400 W at 30 M Hz. Material has a relative permittivity of 8 and power factor of 0.5. Absolute permittivity = 8.854 x 10⁻¹²F/m. Determine the necessary voltage. [7]
4. a) Explain the different laws of Illumination. [7]
- b) Explain the construction and working of Sodium vapour lamp. [7]
5. a) Explain the different types of Lighting Schemes. [7]
- b) An office 25 m x 12 m is illuminated by 40 W incandescent lamps of lumen output 2800 lumens. The average illumination required at the work place is 250 lux. Calculate the number of lamps required to be fitted in the office. Assume utilization and depreciation factors as 0.66 and 1.25 respectively. [7]
6. a) What are the requirements of an ideal traction system? How are they met in an electric traction System? [7]
- b) A train is required to run between two stations 2 Km apart at a schedule speed of 36 Km/h, the duration of stops being 20 seconds. The braking retardation is 2.7 KMPHPS. Assuming a trapezoidal speed – time curve, calculate the acceleration if the ratio of maximum speed to average speed is 1.2. [7]
7. Write short notes on the following:
 - (a) Train resistance and its part in the mechanics of train motion
 - (b) The tractive effort for propulsion of train up and down the gradient. [14]