

III B. Tech I Semester Regular Examinations, Dec/Jan – 2022-23
UTILIZATION OF ELECTRICAL ENERGY
(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**

All Questions Carry Equal Marks

UNIT-I

1. a) Define and elaborate the factors on which the mean spherical candle power will depending up on? [7M]
b) Derive the total illumination of photo meter with relevant diagram and equations? [7M]

(OR)

2. a) What is meant by candle power? Discuss in detail about its average values? [7M]
b) Estimate the number of 900W flood light projectors required to illuminate the upper 77m of one face of a 98m tower of width 14m if approximate initial average luminance is to be 6.87 cd/m^2 . The projectors are mounted at ground level 52m from the base of the tower. The utilization factor is 0.4, the reflection factor of the wall is 22% and the efficiency of each lamp is 16 l m/W? [7M]

UNIT-II

3. a) Describe the detailed classification of electrical drives with relevant characteristics? [7M]
b) Analyze the accelerating mode of fly wheel in load equalization by using necessary expressions? [7M]

(OR)

4. a) Discuss in detail about the effect of speed control in the operation of electrical drive the necessary equations? [7M]
b) Compare the characteristics of continuous and intermittent loads with relevant characteristics? [7M]

UNIT-III

5. a) Describe the design aspects of heating element of electrical heating process? [7M]
b) Compare the requirements and features of resistance welding and arc welding processes? [7M]

(OR)

6. a) Elaborate the characteristic features of arc welding machines? [7M]
b) A resistance oven employing nichrome wire is to be operated from 200V single phase supply and is to be rated at 15.7kW. If the temperature of the element is to be limited to 1070°C and the average temperature of the charge is 510°C , find the diameter and length of the element wire? The radiating efficiency is 0.55, emissivity is 0.8, the specific resistance of nichrome is $109 \times 10^{-8} \text{ ohm-m}$. [7M]



UNIT-IV

7. a) Memorize the technical specifications and operational process of electrical traction in India? [7M]
b) A 330 tonne EMU is started with a uniform acceleration and reaches a speed of 44 km/h in 22 seconds on a level track. Assuming trapezoidal speed time curve, find specific energy consumption if the rotational inertia is 7.8% , retardation is 3.2 kmphps, the distance between the stops is 4km, motor efficiency is 0.85, the train resistance is 42N/tonne? [7M]
(OR)
8. a) Compare the trapezoidal and quadrilateral speed time curves of traction system? [7M]
b) Derive and analyze the power output from the driving axles of electric traction system? [7M]

UNIT-V

9. a) Discuss in detail about the benefits derived through energy storage systems? [7M]
b) Write and explain in detail about the classification of energy storage systems? [7M]
(OR)
10. a) Describe the technical features of electrical energy storage systems? [7M]
b) Draw the diagram and explain the operating principle of chemical heat pump system? [7M]



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UNIT-I

1. a) Derive and analyze the luminance of an extended source? [7M]
 b) A lamp giving out 1010 lm in all directions is suspended 7m above the working plane. Find the illumination at a point on the working plane 5m away from the foot of the lamp? [7M]
 (OR)
2. a) Prove that the illumination is proportional to cosine of angle made by the normal to the illuminated surface with the direction of incident flux? [7M]
 b) Explain the operation of fluorescent lamp and analyze the stroboscopic effect with circuit diagram? [7M]

UNIT-II

3. a) Elaborate the electrical characteristics of a motor used for the electrical drive? [7M]
 b) A 450V series motor having armature and field resistances of 0.28 ohms and 0.32 ohms runs at 540 r.p.m when taking 72A. Assuming un saturated field find out its speed when field diverter of 0.872 ohms is used for the loads whose torque remains constant and varies as square of the speed? [7M]
 (OR)
4. a) Describe the process and components used for transmitting the power in an electrical drive? [7M]
 b) Compare the optimum starting and running characteristics of an electrical drive? [7M]

UNIT-III

5. a) Elaborate the meritorious advantages of electrical heating process? [7M]
 b) Draw and analyze the V-I characteristics of arc welding D.C machines? [7M]
 (OR)
6. a) By drawing the core and winding diagram explain the operation of induction furnace? [7M]
 b) Compare the features of alternating current and direct current welding processes? [7M]

UNIT-IV

7. a) Analyze the properties and advantages of 25kV, 50Hz A.C electrical traction system? [7M]
 b) Derive the relations between the principal quantities used in the traction mechanism? [7M]

(OR)

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8. a) Memorize the SI units of various quantities used in the traction mechanics? [7M]
b) An electric train has an average speed of 48 kmph on a level track between the stops 1600m apart. It is accelerated at 1.6 kmphs and is braked at 4 kmphs. Draw the speed time curve for the train run? [7M]

UNIT-V

9. a) Relate the role of energy demand with respect to the energy storage systems? [7M]
b) Draw the relevant diagram and explain the thermal energy storage system? [7M]

(OR)

10. a) Discuss in detail about the objectives and outcomes of chemical energy storage systems? [7M]
b) Describe how the energy can be stored in a large electro magnet? [7M]



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UNIT-I

1. a) What is meant by luminous intensity? Explain in detail about its average values? [7M]
b) A small light source with intensity uniform in all directions is mounted at a height of 12m above the horizontal surface. Two points A and B both lie on the surface with point A directly beneath the source. How far is B from A if the illumination at B is only $1/8^{\text{th}}$ as greater as A? [7M]

(OR)

2. a) Memorize various sources of light to obtain the illumination and explain the properties of each source? [7M]
b) It is desired to flood light the front of a building 44m wide and 18m height. Projectors of 32° beam spread and 1100W lamps giving 25lumen/watt are available. If the desired level of illumination is $70\text{lm}/\text{m}^2$ and if the projectors are to be located at ground level 16m away, design and show a suitable scheme? The coefficient of utilization 0.5, depreciation factor 1.4, waste light factor 1.6. [7M]

UNIT-II

3. a) Elaborate the mechanical characteristics of a motor used for the electrical drive? [7M]
b) Describe the objectives and outcomes of load equalization of drives with relevant expressions? [7M]
- (OR)
4. a) Discuss in detail about the advantages and applications of an industrial drive? [7M]
b) Analyze the load increasing mode flywheel calculations with relevant equations? [7M]

UNIT-III

5. a) Elaborate various methods of heat transfer with respect to the electrical heating? [7M]
b) Draw the connection diagram and explain about the carbon arc welding process? [7M]
- (OR)
6. a) Compare the features of direct and indirect core type induction furnaces? [7M]
b) List out and write briefly about the equipment used for the process of electrical welding? [7M]



UNIT-IV

7. a) Draw the block diagram and explain the operation of an alternating current locomotive? [7M]
b) A goods train weighing 480 tonne is to be obtained hauled by a locomotive up an ascending gradient of 2.5% with an acceleration of 1.2 kmphps. If the coefficient of adhesion is 0.28, the train resistance 41N/tonne and the effect of rotational inertia is 14%, find the weight of the locomotive and number of axles if the load is not to increase beyond 20 tonne per axle? [7M]
- (OR)
8. a) Compare the speed time characteristics of main line and city traction services? [7M]
b) Derive and analyze the energy output from the driving axles of electric traction system? [7M]

UNIT-V

9. a) Explain the details of energy storage applications relevant to the energy demand? [7M]
b) Discuss in detail about the merits and demerits of electrical energy storage systems? [7M]
- (OR)
10. a) Elaborate the benefits derived through the thermal energy conversion system? [7M]
b) Describe the characteristic features of electro chemical batteries? [7M]



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UNIT-I

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spherical candle power will depending up on?
 - b) Derive the total illumination of an integrating sphere with [7M]
relevant diagram and equations?
- (OR)
2. a) Prove that the illumination of a surface is inversely proportional [7M]
to square of distance of surface from the source?
 - b) Draw the connection circuit diagram and explain the principle of [7M]
operation of high pressure mercury vapour lamp?

UNIT-II

3. a) List out the criterion and explain briefly about the selection of [7M]
driving motor?
 - b) Elaborate the characteristic features of energy efficient motors? [7M]
- (OR)
4. a) Describe in detail about the effect of temperature rise on the [7M]
operation of an electrical drive?
 - b) A 440V, 3 phase squirrel cage induction motor has a full load [7M]
slip of 3%. A stand still impedance of 1.55 ohms and full load
current of 32A. The maximum starting current which may be
taken from the line is 77A. What tapping must be provided on an
auto transformer starter to limit the current to this value and
what would be the starting torque available in terms of full load
torque?

UNIT-III

5. a) List out the types of electrical heating method and write the [7M]
requirements of good heating element?
 - b) Explain in detail about the different possible positions of arc [7M]
welding process?
- (OR)
6. a) Explain with relevant diagram the role of electrode in the metal [7M]
arc welding?
 - b) A 34kW, 3 phase 415V resistance oven is to employ nickel- [7M]
chrome strip 0.284mm thick for the three star connected heating
elements. If the wire temperature is to be 1200°C and that of the
charge is to be 650°C, estimate suitable width of the strip.
Assume emissivity 0.8 and radiating efficiency to be 0.6,
resistivity of the strip material is 101×10^{-8} ohm-m. What is the
temperature of the wire if the charge were cold?



UNIT-IV

7. a) Memorize the systems of electrical traction electrification and discuss the disadvantages? [7M]
b) The average distance between stops on a level section of a railway is 1.22km. Motor coach train weighing 240 tonne has a schedule speed of 34 km/h, the duration of stops being 40 seconds. The acceleration is 1.5 kmphps and the braking retardation is 3.1 kmphps. The train resistance to traction is 48N per tonne. Allowance for the rotational inertia is 8%. Find the specific energy output in Wh/t-km by assuming trapezoidal speed time curve? [7M]

(OR)

8. a) Draw and identify different stages of typical speed time characteristics of traction systems? [7M]
b) Derive the tractive effort required for the propulsion of a train? [7M]

UNIT-V

9. a) Discuss how the peak load energy demand utilizes the energy demand? [7M]
b) Elaborate the technical criterion for the evaluation of thermal energy storage systems? [7M]

(OR)

10. a) Discuss in detail about the objectives and outcomes of magnetic energy storage systems? [7M]
b) Elaborate the process and requirements of electrical energy storage systems? [7M]

