Code No: R203102B **R20** SET - 1

III B. Tech I Semester Regular/Supplementary Examinations, December -2023
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
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UNIT-I

1. a) Derive the illumination on the surface areas by using law of inverse squares? [7M]
   b) Describe the connection diagram and explain the operating principle of vapour discharge lamp? [7M]

(OR)

2. a) Explain how the mean horizontal candle power is determined by using horizontal polar curves with diagrams? [7M]
   b) Deduce the relation to find the illumination at any point on the plane surface due to light source suspended at a height 'h' from the plane surface? [7M]

UNIT-II

3. a) Discuss in detail about different factors governing the selection of electrical motor drives? [7M]
   b) A 220V shunt motor has a field resistance of 387 ohms and armature resistance of 0.2 ohms. The armature current is 52A and the speed is 940 r.p.m. By assuming a straight-line magnetization curve, find the additional resistance in the field to increase the speed to 1100 r.p.m for the same armature current? [7M]

(OR)

4. a) Compare the features of continuous and intermittent loads with characteristics and examples? [7M]
   b) Compare the total annual cost of a group drive with a motor costing Rs 8500 with that of ten individual motors each cost of Rs 2000. With the group drive the annual consumption is 72,000kWh. With separate drives the annual consumption is 47,000kWh. Electrical energy costs 11paise per kWh, Depreciation, maintenance and other fixed charges amount to 16% in case of group drive and 17% in the other case. Discuss the possible reasons for which we may decide in favour of the drive with a higher annual cost? [7M]

UNIT-III

5. a) Discuss in detail about the advantages of electrical heating when compared with other types of heating methods? [7M]
   b) By drawing the circuit diagram, describe the process of electric arc welding? [7M]

(OR)

6. a) Draw the diagram and explain the operation of upset Butt welding with applications? [7M]
   b) A 16kW, 200V single phase resistance oven employs nickel-chrome wire for its heating elements. If the wire temperature is not to exceed 1100^0C and the temperature of the charge is to be 660^0C. Find the diameter and length of the wire. Assume radiating efficiency be 0.7 and emissivity as 0.8. For nickel-chrome resistivity is 1.016×10^{-6} ohm-m? [7M]

UNIT-IV

7. a) Discuss the characteristic features of track electrification with specifications? [7M]
   b) A 210-tonne motor coach having 4 motors, each developing a torque of 7800N-m during acceleration, starts from rest. If up gradient is 32 in 1000, gear ratio 3.4, gear transmission efficiency is 91%, wheel diameter 88cm, train resistance 48 N/t, rotational inertia effect 12%, compute the time taken by the coach to attain a speed of 85 kmph? If the supply voltage is 3300V and the motor efficiency is 75%, find the current taken during the acceleration period? [7M]

(OR)

8. a) Derive and analyze the relation between principal quantities of trapezoidal speed time characteristics of traction systems? [7M]
   b) A train has schedule speed of 66km per hour between the stops which are 10 km apart. Find the crest period over the run, assuming trapezoidal speed-time curve. The train accelerates at 4 kmphps and retards at 5.5 kmphps. The duration of stops is 70 seconds? [7M]

UNIT-V

9. a) Discuss in detail about the objectives and outcomes of energy storage systems? [7M]
   b) Mention the applications and explain the chemical energy storage technologies? [7M]

(OR)

10. a) Compare the thermal and magnetic energy storage systems along with examples? [7M]
    b) Elaborate the advantages and disadvantages of electrical energy storage technologies? [7M]

Code No: R203102B **R20** SET - 2

III B. Tech I Semester Regular/Supplementary Examinations, December -2023
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*****

UNIT-I

1. a) State and prove Lambert's cosine law for the inclined surface illumination? [7M]
   b) Draw neat diagram and explain the principle of operation of high pressure mercury vapour discharge lamp? [7M]

(OR)

2. a) Explain how the mean spherical candle power can be found from vertical polar curve? [7M]
   b) The illumination at a point on a working plane directly below the lamp is to be 110 lumens/m^2. The lamp gives 226 c.p uniformly below the horizontal plane. Find the height at which the lamp is suspended? Also determine the illumination at a point on the working table 1.4m away from the vertical axis of the lamp? [7M]

UNIT-II

3. a) Compare the characteristic features of group drive and individual drives with applications? [7M]
   b) A D.C series motor runs at 1200 r.p.m taking 104A at 410V. A diverter having double the resistance of the field winding is then connected in parallel with it. Estimate the change in speed if the torque varies as the square of the speed. Assume unsaturated field and neglect the losses? [7M]

(OR)

4. a) Derive the relevant relations and explain the running characteristics of D.C shunt motors? [7M]
   b) Compare the features of intermittent and variable loads with characteristics and examples? [7M]

UNIT-III

5. a) Describe the conduction, convection and radiation modes of heat transfer with necessary equations? [7M]
   b) By drawing the circuit diagram, describe the process of metal arc welding? [7M]

(OR)

6. a) Draw the diagram and explain the operation of flash Butt welding with applications? [7M]
   b) A 32 kW, 3 phase, 415V resistance oven is to employ nickel-chrome strip 0.022 cm thick for the 3 phase star connected heating elements. If the wire temperature is to be 1200^0C and that of charge is to be 770^0C. Estimate a suitable width for the strip. Assume radiating efficiency as 0.7 and emissivity as 0.8. The specific resistance of the nichrome-alloy is 1.03×10^{-6} ohm-m? State any assumption made. [7M]

Code No: R203102B **R20** SET - 2

UNIT-IV

7. a) Discuss in detail about the merits and demerits of electric traction systems? [7M]
   b) A goods train weighing 450 tonne is to be hauled by a locomotive up an ascending gradient of 4% with an acceleration of 1.2 kmphps. If the coefficient of adhesion is 0.22, train resistance is 44N/t and effect of rotational inertia 13%, find the weight of the locomotive and number of axels if load is not to increase beyond 22 tonnes/axle? [7M]

(OR)

8. a) Derive and analyze the relation between principal quantities of quadrilateral speed time characteristics of traction systems? [7M]
   b) An electric train is to have acceleration and braking retardation of 1.3 kmphps and 5.6 kmphps respectively. If the ratio of maximum to average speed is 1.5 and the time for stop is 40 seconds, find the schedule speed for a run of 4km. Assume simplified trapezoidal time curve? [7M]

UNIT-V

9. a) Discuss in detail about the need and desirable requirements of energy storage systems? [7M]
   b) Mention the applications and explain the magnetic energy storage technologies? [7M]

(OR)

10. a) Compare the electric and thermal energy storage systems along with examples? [7M]
    b) Elaborate the advantages and disadvantages of chemical energy storage technologies? [7M]

Code No: R203102B **R20** SET - 3

III B. Tech I Semester Regular/Supplementary Examinations, December -2023
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*****

UNIT-I

1. a) Derive the expression for the solid angle from the plane angle by drawing the sectional diagram? [7M]
   b) Elaborate the principles of energy conservation with process outcomes? [7M]

(OR)

2. a) Analyze the Rousseau's construction to determine the mean spherical candle power? [7M]
   b) A lamp of 470W having m.s.c.p of 900 is suspended 2.5m above the working plane. Find the illumination directly below the lamp at the working plane, lamp efficiency, and illumination at a point 2.2m away on the horizontal plane from vertically below the lamp? [7M]

UNIT-II

3. a) Compare the characteristic features of individual drives and multi motor drives with applications? [7M]
   b) A 4 pole D.C series motor runs at 510 r.p.m on 420V supply taking 22A, all the 4 field coils being normally connected in series. Estimate the current and speed of the motor if the field coils are connected in parallel groups of 2 in series. The load torque varies as the square of the speed. Assume the flux to be proportional to the current and neglect the losses? [7M]

(OR)

4. a) Derive the relevant relations and explain the performance characteristics of D.C shunt motors? [7M]
   b) Compare the features of continuous and variable loads with characteristics and examples? [7M]

UNIT-III

5. a) Compare the characteristic features of power frequency heating and high frequency heating methods with applications? [7M]
   b) By drawing the circuit diagram, describe the process of submerged arc welding? [7M]

(OR)

6. a) By using neat diagram, explain the working of spot-welding machine? [7M]
   b) A cubic water tank has surface area of 5.6 m^2 and is filled to 86% capacity six times daily. The water is heated from 22^0C to 66^0C. The loss per square meter of tank surface per 1^0C temperature difference is 5.3W. Find the loading in kW and the efficiency of the tank by assuming specific heat of the water as 4,200J/kg/^{0}C and one kWh is equal to 3.5MJ? [7M]

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UNIT-IV

7. a) Starting from notching up period explain different stages of speed time characteristics of traction systems? [7M]
   b) The average distance between stops on a level section of a railway is 1.22km. Motor coach train weighing 204 tonne has a schedule speed of 33km/hr, the duration of stops is 40 seconds. The acceleration is 1.6 kmphps and the braking retardation is 3.8 kmphps. The train resistance to traction is 47 N/t. Allowance for the rotational inertia is 9%. Determine the specific energy output in Wh/t-km by assuming trapezoidal speed time curve? [7M]

(OR)

8. a) Derive and analyze the tractive effort for the propulsion of the train? [7M]
   b) A suburban electric train has a maximum speed of 88 kmph. The schedule speed including a station stop of 36 seconds is 55 kmph. If the acceleration is 1.3 kmphps, calculate the value of retardation when the average distance between stops is 5.8km? [7M]

UNIT-V

9. a) Describe the thermal energy storage systems along with the advantages? [7M]
   b) Mention the applications and explain the electrical energy storage technologies? [7M]

(OR)

10. a) Discuss in detail about the applications of magnetic energy storage system technology? [7M]
    b) Elaborate the advantages and disadvantages of thermal energy storage technologies? [7M]

Code No: R203102B **R20** SET - 4

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*****

UNIT-I

1. a) Derive and analyze the relationship between solid angle and plane angles with necessary equations? [7M]
   b) Draw the diagrams and explain in detail about specular reflection and diffuse reflections? [7M]

(OR)

2. a) Draw the diagram and explain the procedure for finding the mean spherical candle power using integrating sphere? [7M]
   b) Two lamps are hung at a height of 9.6m from the floor level. The distance between the lamps is 1.4m. Lamp one is 512 c.p. If the illumination on the floor vertically below this lamp is 22 lux, calculate the candle power of the second lamp? [7M]

UNIT-II

3. a) Compare the characteristic features of group drive and multi motor drives with applications? [7M]
   b) A D.C series motor has ratings of 220V, 17A and 1300 r.p.m. Armature and series field resistances are 0.3 ohms and 0.4 ohms respectively. Magnetic circuit can be assumed to be linear. At what speed the motor will run at rated torque if a resistance of 25 ohms is placed in parallel with the armature? [7M]

(OR)

4. a) Draw and analyze the speed-current and torque-current characteristics of D.C shunt motor with necessary relations? [7M]
   b) Describe the characteristic features of energy efficient motors with advantages? [7M]

UNIT-III

5. a) Explain the process of heat dissipation by convection and radiation processes? [7M]
   b) Compare the A.C and D.C welding processes with respect to various applications? [7M]

(OR)

6. a) Discuss about the equipment used for the electric welding process and write their detailed role? [7M]
   b) An electric toaster consists of two resistance elements each of 188 ohms. Find the power drawn from 230V A.C single phase supply, when the elements are connected in parallel and in series? [7M]

UNIT-IV

7. a) Describe the desirable features of motors used for electric traction purpose? [7M]
   b) A 330 tonne EMU is started with a uniform acceleration and reaches a speed of 42 kmph in 22 seconds on a level track. Assuming trapezoidal speed time curve, find the specific energy consumption if rotational inertia is 7%, retardation is 3.3 kmphps, distance between stops is 4.2km, motor efficiency is 0.7 and the train resistance is 38N/tonne? [7M]

(OR)

8. a) Derive and analyze the specific energy consumption of traction system and factors effecting the specific energy consumption? [7M]
   b) An electric train has an average speed of 44 kmph on a level track between stops 1440 m apart. It is accelerated at 1.5 kmphps and is braked at 3.6 kmphps. Draw and analyze the speed time curve for the run? [7M]

UNIT-V

9. a) Describe the electrical energy storage systems along with desirable requirements? [7M]
   b) Mention the applications and explain the thermal energy storage technologies? [7M]

(OR)

10. a) Discuss in detail about the applications of chemical energy storage system technology? [7M]
    b) Elaborate the advantages and disadvantages of magnetic energy storage technologies? [7M]