Code No:**R1641021** **R16** **Set No. 1**

IV B.Tech I Semester Regular/Supplementary Examinations, March- 2021

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
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PART–A *(14 Marks)*

1. a) What are the merits of group drive? [3]
   b) What is meant by a high frequency resistance welding? [3]
   c) What is meant by meter candle? [2]
   d) What is the principle of electric incandescent lamp? [2]
   e) List out the factors affecting the schedule speed? [2]
   f) Define the specific energy consumption? [2]

PART–B *(4x14 = 56 Marks)*

2. a) Discuss the advantages and disadvantages of electric drive over the other drives. [5]
   b) A 25 H.P, 500V, 4-pole, 50Hz cage induction motor with a mesh connected stator takes a full load current of 28A and has a slip of 4%. The impedance per phase is 2.7 ohms. Find the starting torque and starting current taken from the supply if the motor is started by direct switching, a star-delta starter and the auto transformer starter with 65% tapping? [9]

3. a) What are the various types of electrodes used for welding operation? List out the merits of coated electrodes. [7]
   b) A 10kW, 220V, single phase resistance oven employs a wire for its heating elements. If the wire temperature is not to exceed 800 degree centigrade and the temperature of the charge is to be 300 degree centigrade. Find the radius and the length of the wire. Assume the radiating efficiency to be 0.7 and the emissivity as 0.8. Assume the resistivity is 1.016×10^{-6} ohm-meters? [7]

4. a) Explain the measurement techniques for luminous intensity. [7]
   b) A lamp with reflector is mounted 10m above the centre of a circular area of 20m diameter. If this combination of the lamp and the reflector gives a uniform candle power of 1000 over the circular area, find the maximum and minimum illumination produced on the area? [7]

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5. a) Describe the construction and working principle of a fluorescent lamp. [7]
   b) The illumination of a drawing office of 30m x 10m is to have a value of 220 lux and is to be provided by a number of 200W filament lamps. If the utilization factor is 0.3 and the depreciation factor is 0.8, find the number of lamps required. The efficiency of each lamp is 12 lumens per watt? [7]

6. a) Discuss the various systems of the track electrification? [7]
   b) An electric train has an average speed of 44kmph on a level track between stops 1000m apart.it is accelerated at 1.5kmphps and is braked at 3.1kmphps. Draw the speed-time curve for the run? [7]

7. a) Explain the tractive effort to overcome the effect of gravity? [5]
   b) A locomotive of 150 tonnes can just accelerate a train of 450 tonnes with an acceleration of 1.8kmphps up a gradient of 1 in 100. Assume an adhesive weight of locomotive 65% of the total dead weight. The tractive resistance is 35N/tonne and the rotational inertia increases the dead weight by 10%. If the above locomotive is aided by another locomotive of 125 tonnes with 78% adhesive weight, find the additional trailing weight that can be hauled up the same gradient under same conditions, the maximum gradient, trailing hauled load remaining unchanged and the acceleration if both gradient and hauled load remains constant? [9]

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Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B
****

PART–A *(14 Marks)*

1. a) What are the advantages of electric drive? [3]
   b) What are the various types of electric welding? [3]
   c) What is light? [2]
   d) What are the basic types of reflection? [2]
   e) What is electric traction? [2]
   f) Derive the power output from the driving axles. [2]

PART–B *(4x14 = 56 Marks)*

2. a) Discuss the various factors that govern the size and the rating of a motor for particular service. [7]
   b) A 220V shunt motor ha a field resistance of 350 ohms and the armature resistance of 0.2 ohms. The armature current is 35A and the speed is 800 r.p.m. Assuming a straight line magnetization curve, find the additional resistance in the field to increase the speed to 950 r.p.m for the same armature current. [7]

3. a) Explain the carbon arc welding with diagram? List out its merits and demerits. [7]
   b) The power required for dielectric heating of a lab of resin 125 cm^2 in area and 2cm thick is 180W, frequency is 30MHz. The material has a relative permittivity of 5 and the power factor of 0.04. Find the voltage necessary and the current flowing through the material. If the voltage is limited to 550V, what will be the value of the frequency to obtain the same heating? [7]

4. a) Draw the neat diagram and explain the working of high pressure mercury vapour discharge lamp. [9]
   b) A 220V lamp has a total flux of 2500 lumens and takes a current of 0.7A. Find lumens per watt and the mean spherical candle power? [5]

5. a) What is stroboscopic effect? How it can be minimized. [7]
   b) A shop measuring 15m x 30m is illuminated by 15 lamps of 400W each. The luminous efficiency of each lamp is 10 lumens per watt. Allowing a depreciation factor of 0.6 and the coefficient of utilization of 0.4, find the illumination on the working plane? [7]

6. a) Review the existing electric traction in India. [7]
   b) An electric train is to have acceleration and braking retardation of 0.6 km/hour/sec and 2.7 km/hour/sec respectively. If the ratio of maximum to average speed is 1.4 and the time for stops 24 seconds, find the schedule speed for a run of 1.4 km. Assume simplified trapezoidal speed-time curve. [7]

7. a) What are the factors affecting specific energy consumption of train with necessary expressions? [7]
   b) An electric train has an average speed of 48 kmph on a level track between stops 1200m apart. It is accelerated at 1.8 km/hour/second and it is braked at 3.2km/hour/second. Draw the speed time curve and estimate the specific energy consumption. Assume tractive resistance as 45 N/tonne and allow 8% of the rotational inertia. [7]

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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) What are various types of industrial loads? [3]
   b) What are the merits of electric heating? [3]
   c) State the laws of illumination. [2]
   d) List out the objectives of lighting schemes. [2]
   e) What are the merits of electric traction? [2]
   f) Define tractive effort. [2]

PART–B *(4x14 = 56 Marks)*

2. a) Draw and explain the performance curves of a D.C shunt motor. [7]
   b) Find the ratio of starting current to full load current of a 12 H.P 400V, 3-phase induction motor with a star-delta starter. The motor has a full load power factor of 0.7 lagging and an efficiency of 0.85. The short circuit current of motor is 6.8A at 160V. Neglect the magnetizing current. [7]

3. a) Explain the operation of spot welding with neat diagram. [7]
   b) A plywood board 0.5 x 0.25 x 0.02 metre is to be heated from 20^0C to 110^0C in 10 minutes by dielectric heating employing a frequency 30MHz. Find the power required in this heating process. Assume the specific heat of wood 1500J/kg/C^0; weight of the wood 550kg/$m^3$and the efficiency of the process is 55%. [7]

4. a) What do you understand by polar curves? Explain Rousseav's construction for calculating MSCP of a lamp. [7]
   b) A lamp of 440W having mean spherical candle power of 900 is suspended 2.9m above the working plane. Find illumination directly below the lamp at the working plane, lamp efficiency, and illumination at a point 2.8m away on the horizontal plane from vertically below the lamp. [7]

5. a) Describe the basic principle of the control of the light. [7]
   b) It is required to illuminate a drawing hall with an average illumination of about 280 lux. The area of the hall is 30m x 25m. The lamps are to be fitted at 8m height. Find the number and the size of the incandescent lamps required for an efficiency of 14 lumens per watt. Depreciation factor is 0.8 and the utilization factor is 0.5. [7]

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6. a) Describe the special features of traction motor. [7]
   b) A train has schedule speed of 65 km per hour between the stops which are 5 km apart. Find the crest speed over the run, assuming trapezoidal speed – time curve. The train accelerates at 1.7 kmphps and retards at 4 kmphps. The duration of the stops is 55 seconds. [7]

7. a) Explain the principle of energy efficient motors. [7]
   b) A 420 tonnes train is to be hauled by a locomotive up a gradient of 1 in 40 with an acceleration of 1.1 kmphps. Find the weight of the locomotive and the number of axels, if the axle load is not to exceed 22 tonnes. Coefficient of adhesion is 0.21 track resistance 32 N/tonne and effective rotating masses 10% of dead weight? [7]

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Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B
****

PART–A *(14 Marks)*

1. a) What is meant by load equalization? [3]
   b) What are the merits of electric welding? [3]
   c) What is the need of polar curve? [2]
   d) List out the types of lamps used for street lighting. [2]
   e) What is the need of electric braking? [2]
   f) What is meant by adhesive weight of a train? [2]

PART–B *(4x14 = 56 Marks)*

2. a) Explain how would you estimate the rating of motor for the intermittent duty cycle. [7]
   b) A squirrel cage induction motor takes twice full load current and develops half full load torque when switched on with star-delta starter. Find the starting current and starting torque in terms of full load values when started by auto transformer with 35% tapping? [7]

3. a) Draw the diagram and explain about electric arc welding circuit. [7]
   b) A piece of an insulating material 2 cm thick and 120 cm^2 in area is to be heated by the dielectric heating. The material has a permittivity of 5 and a power factor 0.05. The power at 800 V is 300 W. Determine the cycles per second. [7]

4. a) Explain about the horizontal and vertical plane polar curves with diagrams. [7]
   b) Two similar lamps having uniform intensity of 420 candle power in all directions below the horizontal are mounted at a height of 4.6 m. What must be the maximum spacing between the lamps so that the illumination on the ground mid-way between the lamps shall be at least one half the illumination directly under the lamps? [7]

5. a) Explain the principle of operation of street lamp. [7]
   b) A hall 35m X 25m with a ceiling height of 6m is to be provided with a general illumination of 115 lumens/m^2. Taking a coefficient of utilization of 0.3 and depreciation factor of 1.2, find the number of florescent tubes required, their spacing, mounting height and total wattage. Take luminous efficiency of the florescent tube as 44 lumens/watt for 85 watt tube. [7]

6. a) Write the differences between A.C and D.C electrification of traction systems. [7]
   b) An electric train has a schedule speed of 35 kmph between stations 750 m apart. The duration of the stop is 15 seconds, the maximum speed is 15 % higher than the average running speed and the braking retardation is 4 kmphps. Calculate the rate of acceleration required to operate this service? [7]

7. a) What are the modern traction system motors? Explain their features. [7]
   b) Find the specific energy consumption if a maximum speed of 12.22m/s and for a given run of 1520 m an acceleration of 0.365 m/s^2 are desired. Train resistance during acceleration is 54.8/1000kg and during coasting is 5.14 newtons /1000 kg, 10% being allowable for the rotational inertia. The efficiency of the equipment during the acceleration period is 58%. Assume the quadrilateral speed-time curve? [7]