

III B.Tech II Semester Regular Examinations, Apr/May 2006
UTILISATION OF ELECTRICAL ENERGY
(Electrical & Electronic Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Though a.c. is superior to d.c. for electric drives, sometimes d.c. is preferred. Give the reasons and mention some of the applications. [8]
(b) A d.c. series motor drives a load, the torque of which varies as the square of the speed. The motor takes current of 30 amps, when the speed is 600 r.p.m. Determine the speed and current when the field winding is shunted by a diverter, the resistance of which is 1.5 times that of the field winding. The losses may be neglected. [8]
2. (a) Derive an expression for the time-dependent temperature as the electrical apparatus cools, in terms of the cooling time constant. [8]
(b) A 60 h.p. motor has a final temperature rise of 45 degrees C on continuous full load. Its heating and cooling time constants are 100 and 150 minutes, respectively. The load cycle is as follows:
20 minutes at a certain load and 40 minutes on no-load.
Find the rating of the motor. [8]
3. (a) Explain with a neat sketch the principle of coreless type induction furnace. [8]
(b) 100Kg of tin is to be smelt in one hour in a smelting furnace. Determine the suitable rating of furnace if smelting temperature of tin is 235°C ; specific heat is 0.055, latent heat of liquidification 13.3 Kcal/Kg. Take initial temperature of metal as 35°C . [8]
4. (a) What are various types of electric braking used? [8]
(b) Explain how rheostatic braking is done in D.C. shunt motors and series motors. [8]
5. (a) Explain the measurement techniques used for luminous intensity. [8]
(b) Write short notes on: [8]
 - i. Bunsen photometer head
 - ii. Lummer - Brodherm photometer head
 - iii. Flicker photometer head.
6. (a) Discuss about street lighting. [8]
(b) Compare in detail the various features of industrial lighting and domestic lighting. [8]
7. (a) Describe about duplication of railway transmission lines. [8]

- (b) Write short notes on feeding and distributing system on A.C Traction and for d.c tram ways. [8]
8. (a) Explain briefly the tractive effort required, while the train is moving up the gradient and down the gradient. [8]
- (b) An electric train weighing 450 tonnes has to maintain an average speed of 40km/hr between two stations 3km apart on an incline of 1 in 200. The train accelerates at 2km/hr/sec and retards at 3km/hr/sec. The tractive resistance is 5kg/tonne and the allowance for rotational inertia is 10%. Assuming a trapezoidal speed-time curve, find the energy consumption for the run, while going up the gradient. The overall efficiency be taken as 65%. [8]

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1. (a) Compare and contrast the slip ring and squirrel cage induction motors from the application point of view. [6]
(b) A series motor working on 500 V d.c supply runs at a speed of 1000 r.p.m. When The load current is 120 amps. The resistance of the motor 0.15 Ohm, of which 0.04 Ohm is the resistance of the field. Calculate the speed of the motor when the torque is half of the full load torque and the field winding is connected in parallel with a diverter of resistance 0.08 Ohm, assuming an unsaturated magnetic circuit. [10]
2. (a) Discuss the various modes of heat dissipation. [6]
(b) A motor driving a load has to deliver a load rising uniformly from zero to a maximum of 2000 h.p. in 20 sec during the acceleration period, 1000 h.p. for 40 sec during the full speed period and during the deceleration period of 10 sec when regenerating braking is taking place the h.p. returned to the supply falls from 330 to zero. The interval for decking before the next load cycle starts is 20 sec. Estimate the horse power rating of the motor. [10]
3. (a) Give relative advantages and disadvantages of direct and indirect electric arc furnaces. [8]
(b) An electric arc furnace consuming 5KW takes 15 minutes to just melt 1.5Kgs of aluminum, the initial temperature being 15°C . Find the efficiency of the furnace. Specific heat of aluminum is 0.212, melting point 658°C and latent heat of fusion is 76.8 Cal per gram. [8]
4. (a) What are the various types of motors used for electric traction? [8]
(b) What are the criteria followed for selection of motors for electric drive? [8]
5. Define [4x4=16]
 - (a) Mean spherical Candlepower
 - (b) Mean horizontal Candlepower
 - (c) Mean hemispherical Candlepower
 - (d) Luminous flux.
6. (a) Discuss about filament design incandescent lamps. [8]
(b) What are the various factors involved in the selection of lamps and the illumination required for street lighting. [8]

7. (a) Discuss the merits and demerits of the D.C and 1 - ϕ A.C systems for the main and suburban line electrification of the railways. [8]
(b) Which system you consider to be the best for the suburban railways in the vicinity of large cities? Give reasons for your answer. [8]
8. (a) For a trapezoidal speed-time curve of an electric train, derive expression for maximum speed and distance between stops. [8]
(b) A mail is to be run between two stations 5kms apart at an average speed of 50km/hr. If the maximum speed is to be limited to 70km/hr, acceleration to 2km/hr/sec, braking retardation to 4km/hr/sec and coasting retardation to 0.1km/hr/sec, determine the speed at the end of coasting, duration of coasting period and braking period. [8]

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1. (a) Why and where is an individual drive recommended. [8]
(b) The speed of a 15 h.p. (Metric) 400 V d.c. Shunt motor is to be reduced by 25% by the use of a controller. The field current is 2.5 amps and the armature resistance is 0.5 Ohm. Calculate the resistance of the controller, if the torque remains constant and the efficiency is 82%. [8]
2. (a) Discuss the various modes of heat dissipation. [6]
(b) A motor driving a load has to deliver a load rising uniformly from zero to a maximum of 2000 h.p. in 20 sec during the acceleration period, 1000 h.p. for 40 sec during the full speed period and during the deceleration period of 10 sec when regenerating braking is taking place the h.p. returned to the supply falls from 330 to zero. The interval for decking before the next load cycle starts is 20 sec. Estimate the horse power rating of the motor. [10]
3. (a) What is skin effect? How is this effect made use of in heating? [8]
(b) Write the expression for skin depth. What are the applications of heating? [8]
4. (a) Explain the characteristics of D.C. compound motors and explain its advantage over the series motor. [8]
(b) What are the requirements to be satisfied by an ideal traction system? [8]
5. (a) Explain how the determination of Mean horizontal luminous intensity and polar curve is made. [8]
(b) Find the height which a light having uniform spherical distribution should be placed over a floor in order that the intensity of horizontal illumination at a given distance from its vertical line may be greatest. [8]
6. (a) Discuss the flood lighting with suitable diagrams. [8]
(b) What do you understand by polar curves as applicable to light source? Explain. [8]
7. (a) Discuss relative merits of [8]
 - i. 1500 Volts D.C
 - ii. 25 KVsingle phase 50 Hz rectifier locomotive system for the main line electrification of a railway in an industrial belt where a grid network exists.

- (b) Describe briefly with the help of neat sketch the single and double cater many over head line construction for railways. [8]
8. (a) For a trapezoidal speed-time curve of an electric train, derive expression for maximum speed and distance between stops. [8]
- (b) A mail is to be run between two stations 5kms apart at an average speed of 50km/hr. If the maximum speed is to be limited to 70km/hr, acceleration to 2km/hr/sec, braking retardation to 4km/hr/sec and coasting retardation to 0.1km/hr/sec, determine the speed at the end of coasting, duration of coasting period and braking period. [8]

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1. (a) Discuss the advantages and disadvantages of electric drive over other drives. [8]
(b) A 220 V, 10 h.p. (metric) shunt motor has field and armature resistances of 120 Ohms and 0.25 Ohm, respectively. Calculate the resistance to be inserted in the armature circuit to reduce the speed to 700 r.p.m. from 950 r.p.m, if the full load efficiency is 80% and the torque varies as the square of the speed. [8]
2. (a) Discuss the various losses that occur in insulating materials and how they can be reduced. [6]
(b) A motor has the following load cycle:
Accelerating period 0 -15 sec Load rising uniformly from 0 to 1000 h.p
Full speed period 15-85 sec Load constant at 600 h.p.
Decelerating period 85-100 sec H.p. returned to line falls uniformly from 200 to zero
Decking period 100-120 sec Motor is stationary.
Estimate the size of the motor. [10]
3. (a) What are the applications of high frequency eddy current heating? Also explain the principle of high frequency eddy current heating. [8]
(b) Estimate the energy required to melt one ton of brass in a single phase induction furnace. If the melt is to be carried out in $1\frac{1}{4}$ hrs, what must be the average power input to the furnace? Specific heat of brass = 0.094, Latent heat of fusion = 38.88Kcal/Kg, Melting point of brass = $920^{\circ}C$, Furnace efficiency = 70%. [8]
4. (a) What are the requirements of good electric braking? [6]
(b) Explain the method of rheostatic braking. [10]
5. (a) Discuss inverse square law & cosine law of Illumination. [6]
(b) A lamp fitted with 120 degrees angled cone reflector illuminates circular area of 200 metres in diameter. The illumination of the disc increases uniformly from 0.5 metre-candle at the edge to 2 metre-candle at the centre. Determine [10]
 - i. the total light received
 - ii. Average illumination of the disc
 - iii. Average c.p. of the source

6. Along the center of a line of a corridor, number of lamps are fitted with reflectors. The distance between the two adjacent lamps is 7.5cm and the height of each lamp from the floor is 5m. The candlepower of each lamp is 100 in all directions below the horizontal. Determine the maximum and minimum illumination along the centerline of the floor and draw a graph showing the variation of the illumination along this line between the two lamps. [16]
7. (a) Discuss relative merits of [8]
- i. 1500 Volts D.C
 - ii. 25 KV
single phase 50 Hz rectifier locomotive system for the main line electrification of a railway in an industrial belt where a grid network exists.
- (b) Describe briefly with the help of neat sketch the single and double catenary overhead line construction for railways. [8]
8. (a) Derive expression for the tractive effort for a train on a level track. [8]
- (b) The maximum speed of a suburban electric train is 60km/hr. Its scheduled speed is 40km/hr and duration of stops is 30sec. If the acceleration is 2km/hr/sec and distance between stops is 2kms, determine the retardation. [8]
