

**ELECTRIC DRIVES & POWER UTILIZATION  
(ELEC 4101)**

**Time Allotted : 3 hrs**

**Full Marks : 70**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and  
any 5 (five) from Group B to E, taking at least one from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

**Group - A  
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Which type of braking is not possible in series motor?  
(a) Regenerative braking (b) Dynamic braking  
(c) Counter current braking (d) Rheostat braking.
- (ii) An elevator drive is required to operate in  
(a) one quadrant only (b) two quadrants  
(c) three quadrants (d) four quadrants.
- (iii) In which braking the supply terminals are reversed?  
(a) Regenerative braking (b) Dynamic braking  
(c) Plugging (d) Counter current braking.
- (iv) The advantage of electric traction over other methods is  
(a) no pollution problems (b) faster acceleration  
(c) better braking action (d) all of the above.
- (v) What type of electric drive is used in cranes?  
(a) Multimotor (b) Group  
(c) Individual (d) Both (a) and (c).
- (vi) The specific energy consumption of a train depends on which of the following?  
(a) Gradient (b) Acceleration and retardation  
(c) Distance covered (d) All of (a), (b) and (c) .
- (vii) The friction at the track is proportional to  
(a) speed (b) 1/speed  
(c) time (d) 1/time.
- (viii) The unit of luminous flux is  
(a) steradian (b) candela  
(c) lumen (d) lux.

- (ix) The main advantage of dielectric heating is that  
(a) heating occurs in the material itself  
(b) heating occurs due to high frequency  
(c) it can be used for drying the explosives  
(d) none of (a), (b) and (c) .
- (x) The metal surfaces for electrical resistance welding must be  
(a) rough (b) clean  
(c) moistened (d) coloured.

**Group - B**

2. (a) What are the functions of a power modulator used in an electric drive?  
(b) Mention four criteria for the choice of electric drive.  
(c) Write down the fundamental torque equation. Explain the significance of each term. What are the conditions of acceleration and deceleration?  
**4 + 4 + 4 = 12**
3. (a) A motor drives two loads. One has rotational motion. It is coupled to the motor through a reduction gear with  $a=0.1$  and efficiency of 90%. The load has a moment of inertia of 10 kg-m<sup>2</sup> and a torque of 10 N-m. Other load has translational motion and consists of 1000 kg weight to be lifted up at a uniform speed of 3 m/s. Coupling between this load and motor has an efficiency of 85%. Motor has inertia of 0.3 kg-m<sup>2</sup> and runs at a constant speed of 1420 rpm. Determine equivalent inertia referred to motor shaft and power developed by motor.  
(b) Calculate the equivalent current, torque and power for fluctuating and intermittent loads.  
**7 + 5 = 12**

**Group - C**

4. (a) Explain the process of dynamic braking in a dc drive. Draw the speed torque curve for dynamic braking with variable armature resistance in a separately excited motor.  
(b) A 200 V, 10.5 A, 2000 rpm shunt motor has armature and field resistances of 0.5 Ω and 400 Ω respectively. It drives a load whose torque is constant at rated motor torque. Calculate motor speed if the source voltage drops to 175 V.  
**7 + 5 = 12**
5. (a) Compare VSI and CSI.  
(b) Explain static rotor resistance control for an induction motor in detail.

- (c) Explain any one method for speed control of induction motor.

**3 + 6 + 3 = 12**

**Group - D**

6. (a) Draw and explain general speed time curve of a train running between two stations. How can be this curve is approximated for main line and suburban service.

- (b) An electric locomotive is required to haul a train of 12 coaches each weighing 30 tonnes on the main line service requiring an initial acceleration of 0.8 kmphps up a gradient of 1 in 100. Estimate the adhesive weight and hence the number of driving axles the locomotive must have if the permissible axle loading is 20 tonnes per axle assuming rotational inertia to be 4 % coaches and 15% for the locomotive. Maximum coefficient of adhesion is 0.2 and the tractive resistance 5 Kg/tonne.

**6 + 6 = 12**

7. (a) Why d.c. series motors are preferred for electric traction drive?

- (b) Write short notes on conductor rail system.

**6 + 6 = 12**

**Group - E**

8. (a) Define the term (i) Candle Power (ii) Illumination (iii) Lux.

- (b) A 110 V lamp develops 16 CP and lamp of the same material and working at the same efficiency develops 25 CP on 220 V. Compare the diameter and length of the filaments.

**6 + 6 = 12**

9. (a) Define the following terms:

- (i) Depreciation factor (ii) Cosine inverse law (iii) Polar curve.

- (b) With the help of circuit diagram describe high pressure mercury vapour lamp.

**6 + 6 = 12**