Registration No. : | | | | | | | | | | |

*Total number of printed pages – 3*

**B. Tech**

**PEEL 5303**

# Sixth Semester Regular Examination – 2015

## ELECTRIC DRIVES

## BRANCH (S) : EEE, ELECTRICAL

**QUESTION CODE : J 464**

**Full Marks – 70**

**Time : 3 Hours**



*Answer Question No. **1** which is compulsory and any **five** from the rest.*

*The figures in the right-hand margin indicate marks.*

1. Answer the following questions : 2×10

   (a) What is the difference between active and passive loads ?

   (b) T (motor torque) = $1 + 2\omega_m$ and $T_l$ (load Torque) = $3\sqrt{\omega_m}$ , find the equilibrium points and the stability.

   (c) What are the modes in which a single phase half controlled rectifier fed separately excited dc motor operates ?

   (d) Why the cost of the converter required for fast transient response in dc motor drives is high ?

   (e) What is the relation (graphical) between stator current and rotor frequency of an induction motor whose speed is controlled from a current source ?

   (f) $P_{in} = 3VI_s \cos\phi\ \Phi$ , in an induction motor. When $\phi\ \Phi > 90°$ braking is achieved, justify.

   (g) What are the different classes of motor duty ?

   (h) Draw the block diagram for speed control of multiple synchronous motors.

   (i) What are the conditions upon which the co-efficient of adhesion depends ?

   (j) How the speed ranges are improved in a Kramer drive ?

2. (a) A separately excited D C motor was brought down to rest from its initial speed of 1600 rpm and a load torque which is proportional to speed and

equal to 20% of the rated motor torque at 1500 rpm by dynamic braking. The motor has the following parameters: 220V, 1500 rpm, 50A, $R_a = 0.5\,\Omega$, $L_a = 50mH$. Determine the braking resistance, so as to limit the armature current to twice the rated value, neglecting the effect of armature inductance. Also find the rated torque and load toque applied. 5

(b) Why do we go for load equalisation in drives ? Derive the expressions for calculating the moment of inertia of the flywheel, required for load equalisation 5

3. (a) A 230V, 1200 rpm, 15A separately excited motor has an armature resistance of 1.2 Ω. The motor is operated under dynamic braking with chopper control. Braking resistance is 20 Ω. What will be the duty ratio for a speed of 1000 rpm and a braking torque equal to 1.5 times the rated torque ? What will be the speed for a duty ratio of 0.5 and motor torque equal to rated torque ? 5



(b) What is steady state stability in drives ? Prove that $\frac{dT_l}{d\omega_m} > \frac{dT}{d\omega_m}$ for stable operation. 5

4. (a) Why regenerative braking is not possible in case of DC series motor. Discuss the dynamic braking of DC series motor. 4

(b) A 230V, 650 rpm, 100A, separately excited DC motor has $r_a = 0.5\,\Omega$ and $L_a = 8mH$. The motor is controlled by a single phase half controlled rectifier with a source voltage of 230V, 50HZ. Find the speeds and find the modes of operation for (a) $\alpha = 60°$, $T = 1000\ N - m$ 6

5. (a) Mention the methods those control the speed of a induction motor by feeding back some of the power to the ac source. Explain scherbious drive. 6

(b) Explain the constant power and constant torque mode operation in variable frequency control of an induction motor. 4

6. (a) What are the advantage and disadvantage of DC traction using PWM voltage source inverter in an induction motor drive ? 5

(b) An electric train weighing 500 tonnes climbs an up gradient with G=10 and has the following speed-time curve :

(i) Uniform acceleration of 1.5 kmphps for 100 sec

(ii) Constant speed for 60 min

(iii) Coasting for 3 min

(iv) Dynamic braking at 2 kmphps to rest.

Train resistance is 30 N/tonne, rotational inertia effect 10% and combined efficiency of transmission, motor and the power modulator is 85%. Determine, average speed and specific energy consumption. 5

7. Describe the Control of DC Drives using Microprocessors. Also discuss the advantage and disadvantage. 10

8. Write short notes on any **two** : 5×2

(a) Energy loss in transient operation

(b) Drives for cement mills

(c) Plugging (ac)

(d) 25kV AC traction using on load transformer tap changer.