Registration no: | | | | | | | | | | |

Total Number of Pages: 2 **B.Tech**
PEEL5303

6th Semester Regular / Back Examination 2015-16
ELECTRIC DRIVES
BRANCH: EEE, ELECTRICAL
Time: 3 Hours
Max Marks: 70
Q.CODE:W524

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: **(2 x 10)**

a) Find the equilibrium points and determine their steady state stability when motor and load torques are given by $T = -1 - 2\omega_m \ and$
$T_l = -3\sqrt{\omega_m}$

b) A low power rated motor can be selected for short time duty with higher load demand.Justify?

c) Find the voltage across the semi converter fed separately excited DC motor just after the freewheeling period in discontinuous mode.

d) Draw the average voltage vs firing angle characteristics of two quadrant dc drive.

e) What is the difference between current source inverter controlled induction motor drive and voltage source induction motor drive, if there is a commutation failure in any one of the three legs?

f) In a static scherbius drive, how the inverter transformer turn ratio is selected and why?

g) Draw the block diagram of variable frequency control of multiple synchronous motors.

h) The 25kV ac traction using semi converter controlled DC motor is used for low power shunting locomotives. It cannot be used for suburban and main line trains.Why?

i) Define co-efficient of adhesion. Mention the factors upon which it depends.

j) Define passive and active load torques with examples.

Q2 **a)** A drive has the following parameters: J=1kg-m^2, T=15-0.01N, N-m and passive load torque T_l=0.005N, N-m; where N is speed in rpm. Initially the drive is operating in steady state. Now it is to be reversed. For this motor characteristic is altered such that T=-15-0.04N, N-m for positive as well as negative values of N. calculate the reversal time. **(5)**

b) A 220V, 960 rpm and 80A DC series motor is driving a load which has the same torque at all speeds. Resistance of armature and field are 0.05Ω each. Calculate direction and magnitude of motor speed and current if the motor voltage is changed from 220V to -200V and the number of turns in the field winding is reduced to 80%. Will motor speed reverse? Assume linear magnetic circuit. **(5)**

Q3 **a)** In a single phase fully converter fed separately excited DC motor, find the expression for armature current, average output voltage of the converter and determine the critical speed of the motor. **(5)**

b) A 230V, 650 rpm, 100A separately excited DC motor has armature resistance of 0.08Ω and armature inductance of 8mH. Motor is controlled by a semi converter with source voltage of 230Vand 50Hz. Identify the mode of operation and calculate the speed for $\alpha=60^0$ and torque of 1000N-m. **(5)**

Q4 **a)** A 230V, 1200 rpm, 15A separately excited DC motor has an armature resistance of 1.2Ω. Motor is operated under dynamic breaking with chopper control. Breaking resistance is 20Ω. Calculate the duty ratio of the chopper for motor speed of 1000 rpm and breaking torque equal to 1.5 times rated torque. **(5)**

b) Explain static scherbius drive with all expressions. What is the inverter power rating if speed is controlled below synchronous speed by x%. **(5)**

Q5 A 3 phase, 440V, 6-pole, 970 rpm, 50Hz, Y-connected induction motor has the following parameters referred to the stator. Rs = .2Ω, R_r' = 0.15Ω, X_s = X_r' = 0.4Ω. The rotor to stator turn ratio is 3.5. The motor speed is controlled by the static scherbius drive. The drive designed for a speed range of 30% below the synchronous speed. The maximum value of firing angle is 170^0. Calculate the turn ratio of the transformer and torque for a speed of 750 rpm and $\alpha=140^0$. **(10)**

Q6 **a)** Explain current regulated voltage source inverter fed induction motor **(5)**

b) Explain the dc traction using semiconductor chopper controlled dc motors. **(5)**

Q7 **a)** A 500 tonne train moves as follows: **(10)**

(i) uniform acceleration of 3kmphps on a level trackfor 1 min
(ii) constant speed for 30 min up gradient with G=10
(iii) constant speed for 30 min on down gradient with G=20
(iv) coasting for 5 min on a level track
(v) regenerative braking to stop at 3 kmphps on a level track.

Train resistance is 30 N/tonne, rotational inertia effect 10% and combined efficiency of power modulator, motor and transmission both during motoring and braking is 85%. Calculate the specific energy consumption.

Q8 Write short notes on any two: **(5 x 2)**

a) Explain regenerative braking of a separately excited DC motor by chopper control.

b) Explain pole amplitude modulation method of speed control of an induction motor.

c) Drives in paper mills.

d) Control of DC Drives using Microprocessors.