

COLLEGE OF ENGINEERING

Department of Electrical Engineering

B.Tech Electrical

ESE : ELECTRIC DRIVES (EE-0E-14009)

Year: 2014-15 AUTUMN SEMESTER Date: 28th Nov. 2014

Duration: 3 hrs [2 to 5 pm]

Max. Marks: 100

Instructions:

- Solve any **FIVE** questions
- State clearly the assumptions made, if any.
- Begin new question from new page

Q1	a	A weight of 500 kg is being lifted up at a uniform speed of 1.5 M/S by a winch driven by a motor running at a speed of 1000 rpm. The moments of inertia of the motor and winch are 0.5 and 0.3 kg-m ² respectively. Calculate the motor torque and the equivalent moment of inertia referred to the motor shaft. In the absence of the weight, motor develops a torque of 100 N-m when running at 1000 rpm	8
	b	A drive has following equations for motor and load torques $T = (1 + 2\omega_m) \text{ and } T_L = 3\sqrt{\omega_m}$ Obtain the equilibrium points and comment on their steady state stability.	8
	c	Give the circuit which can be used to run a separately excited dc shunt motor in all four quadrants	4
Q2	a	A motor equipped with fly wheel has to supply a load torque of 600 N-m for 10 sec followed by a no load period long enough for the flywheel to regain its full speed. It is desired to limit the motor torque to 450 N-m. What should be the moment of the inertia of the fly wheel? The no load speed of the motor is 600 rpm and it has a slip of 8 % at torque of 400 N-m. Assume the motor speed torque characteristic to be a straight line in the range of operation. Motor has an inertia of 10 kg-m ² .	8
	b	A drive consisting of semiconductor converter fed dc motor runs according to following periodic duty cycle Uniform Acceleration from standstill to 1000 rpm in 10 sec. Running at 1000 rpm and 800 N-m torque for 8 sec Braking from 1000 rpm to standstill in 10 sec at uniform deceleration Remains idle for 20 sec. Determine the torque and power ratings of the machine. Assume forced cooling and constant field current J=100 kg-m ² .	8
	c	Explain the operation of a closed loop speed control scheme with inner current control loop.	4

Q3	a	A 230 V, 1000 rpm, 105 A separately excited dc motor has a armature resistance of 0.06 ohms. Calculate the value of flux as the rated flux for motor speed of 1500 rpm when load is such that the developed motor power is maintained constant at rated value for all speeds above rated speed.	8
	b	A 220 V, 1500 rpm, 50 A separately excited motor has armature resistance of 0.5 ohms. It is fed from a 3 phase fully controlled rectifier. Available AC source is of 440 V, 50 Hz. A star-delta connected transformer is used to feed the armature so that the motor terminal voltage equals the rated voltage when firing angle is zero. Calculate the transformer turns ratio. Determine the firing angle when motor is running at 1200 rpm and delivering the rated torque. Assume continuous conduction.	8
	c	List of the types of braking used for dc motors. Explain any one of those.	4
Q4		Answer the following	
	a	Compare Voltage fed drive with Current fed drive	6
	b	Compare BLDC with PMSM	6
	c	List of the salient features of V/F control and explain the scheme.	8
Q5		Starting from 3 phase stator winding and 3 phase rotor winding, step by step develop d-q model of induction motor in synchronously rotating reference frame and derive the expression for electromagnetic torque developed by the motor in terms of d-q axes currents and flux linkages.	20
Q6	a	Give the block diagrams for direct and indirect vector control of induction motor.	8
	b	Show the Sheirbus Drive and explain super-synchronous motoring and sub synchronous generation.	8
	c	Obtain equations to calculate the switching angles for the single phase unipolar selected harmonic elimination technique so as to control the fundamental and eliminate the 3 rd harmonic.	4
Q7	a	It is required to generate a space vector of magnitude $0.6 * V$ dc positioned at 90° from the origin in CCW direction for 0.555 milliseconds. Arrive at switching sequences for all devices in 3 phase inverter employing space vector modulation.	12
	b	Explain basic operation of SRM and give any topology to drive this motor.	08
GOOD LUCK !!			