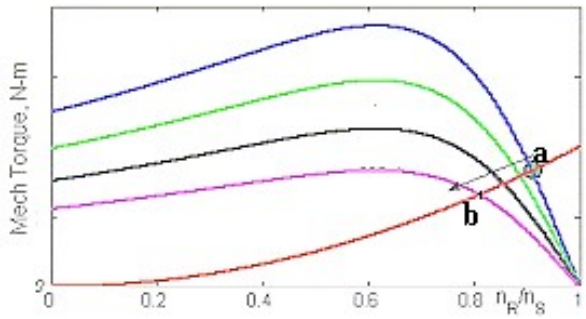
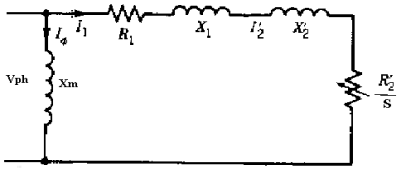
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

Course: ELECTRIC DRIVES – PSEG 329 **Semester: VIII**
Program: B TECH PSE
Time: 03 hrs. **Max. Marks: 100**

Instructions:

SECTION A (5x4=20M)

S. No.		Marks	CO
Q 1	List out the factors limits the maximum speed of field controlled dc motors.	**4**	**CO1**
Q2	Describe the roles of overcurrent and overload protections in a drive system.	**4**	**CO1**
Q3	Explain why stator voltage control is an inefficient method of induction motor speed control ?	**4**	**CO4**
Q4	Explain the drawbacks associated with the operation of induction motor with unbalanced supply voltage.	**4**	**CO4**
Q5	Explain the reasons for using load equalisation in an electrical drives?	**4**	**CO1**
	SECTION B (10x4=40M)		
Q 6	Explain how the following speed transitions are carried out i. Increase in speed in the same direction ii. Decrease in the speed (with and without regenerative breaking) iii. Speed reversal. Note: Use Four quadrant of operation to explain, Draw motor and load characteristics	**10**	**CO2**
Q7	A chopper(class A) controls the speed of a separately excited DC motor having Ra=0.8Ω , La=25mH and motor constant KΦ=0.05 V/rpm. The supply voltage to the chopper is 150V DC and the motor drives a constant torque load requiring an average armature current of 20A. Assuming continuous motor current,calculate a) The range of speed b) Duty cycle range	**10**	**CO2**
Q8	The speed of a 110 V, 5 hp dc motor is controlled by a 1 ϕ ac/dc full converter (i.e., controlled rectifier). The ac supply is 120 V, 50 Hz. Consider the dc motor and converter to be ideal and lossless. Assume a very large inductance in series with the motor. The motor voltage constant is 0.055 V/rpm. (a)Draw the power circuit. (b) For a speed of 1000 rpm and rated motor current, i. Determine the firing angle of the converter. ii. Determine the rms value of the supply current and thyristor current. iii. Determine the supply power factor. iv. Draw waveforms of the supply voltage, supply current, converter output voltage, and converter output current.	**10**	**CO2**
Q9	Explain how below mentioned breaking techniques are employed for an 3ϕ Induction motor with the help of slip-torque characteristics.	**10**	**CO3**

	i. Regenerative braking ii. Dynamic braking		
SECTION-C (2x20=40M) (Internal choice to attempt any one from Q10 and Q11)			
Q 10	A two quadrant chopper operating in first and fourth quadrants is operated from a 200V DC supply. The load is separately excited DC motor having R_a=0.15Ω, L_a= 15mH and E_b=100V . Determine a) Duty cycle for operating under rated load b) Critical duty cycle for regenerative breaking c) Duty cycle to achieve regen-breaking at the rated current of 12A d) Power returned to the source	**20**	**CO3**
Q11	A 2.8k W , 400V , 50Hz ,4Pole ,1370 rpm , delta connected squirrel-cage indudction motor had a following parameters referred to stator : Rs=2Ω, R_r'= 5Ω , Xs=Xr'= 5 Ω , Xm=80 Ω. Motor speed is controlled form a stator voltage control . when driving a load torque is proportional to speed square (T_L=K*(1-s)^2) at rated speed at rated voltage .Value of K= 57.7Calculate (i) motor terminal voltage , current ,and torque at operating point "b"  (ii)Motor speed , current and torque for terminal voltage of 200V Note :consider below circuit for the analysis  	**20**	**CO2**
Q12	Explain which type of chopper circuit used to achieve all quadrant operation only of a separately excited DC-motor driving a hoist load. With the help of the circuit diagram , Voltage Vs Current Quadrant , Torque Vs Speed Quadrants and necessary output wave forms. And also explain how the regenerative breaking can be achieved.	**20**	**CO2**
Name: **Enrolment No:**			

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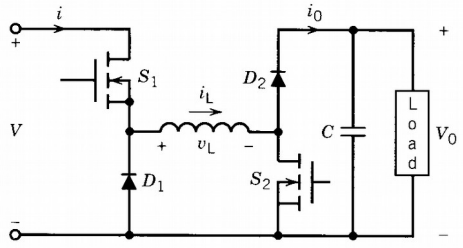
Instructions:

SECTION A (5x4=20M)

S. No.		Marks	CO
Q 1	State and explain the important features of various breaking methods of dc motors.	4	CO1
Q2	List the measures that could be taken to conserve energy in electrical drives	4	CO2
Q3	Explain why stator voltage control is suitable for speed control of induction motors in fan and pump drives.	4	CO2
Q4	Explain the drawbacks associated with the operation of induction motor with unbalanced rotor impedances.	4	CO2
Q5	Explain what do you understand by the steady-state stability ? Mention the main assumptions?	4	C02
	SECTION B (4 x 10M = 40 M)		
Q6	Describe the operation of closed loop torque control scheme and closed loop speed control scheme with inner current control loop.	10	CO3
Q7	Analyze the stepdown chopper with DC Motor (RLE Load) and derive the expression for the peak-peak ripple current and find out the boundary condition for continuous current.	10	CO2
Q8	In the chopper circuit shown in Fig. below, the two switches are simultaneously turned on for time ton and turned off for time $t_{off} = T - t_{on}$, where T is the chopping period. Assume voltage Vo to be ripple-free and current i_L to be continuous. (a)Derive an expression for Vo as a function of the duty cycle D = t on/T and the supply voltage Vs and determine Vo for duty cycles D = 0, 0.5, 1.0. (b) Draw waveforms of Vo, V_L, I_L; for D= 2/3 	10	C04
Q9	Electric motors are used, and to control them electrical drives are employed. But the operating time for all motors is not the same. Some of the motors run all the time, and some of the motor's run time is shorter than the rest period. Depending on this, explain the concept of classification of motor duty class depending up on their application in detail with the help of Torque Vs Time characteristics.	10	C02

SECTION-C (2x20=40M) (Internal choice to attempt any one from Q10 and Q11)			
Q 10	A class-A chopper feeds an inductive load of 10Ω and 40m.H and back emf of 100V DC from a 350V Dc source . If the chopper frequency is 200Hz and the duty cycle is 0.25, determine (a) the load average and RMS voltage (b)the min and max output current, hence the out ripple current (c)sketch load voltage and load current .	**20**	**CO3**
Q11	A 3-Phase , 400V 50Hz 4Pole 1460rpm, star connected IM has R_1=1Ω, R_2^I=1Ω X_1=1.5 Ω , X_2^I=1.5 Ω. A VSI controls this motor keeping V/f raio constant . Calculate the maximum torque and starting current at 15Hz and compare these values when the motor operated at rated frequency	**20**	**CO2**
Q12	Explain operating principle how brushless dc motor (BLDC) when employed from a Voltage Source Inverter(VSI) and draw the variation of Induced voltages , Phase currents and torque waveforms of a BLDC motor	**20**	**CO4**