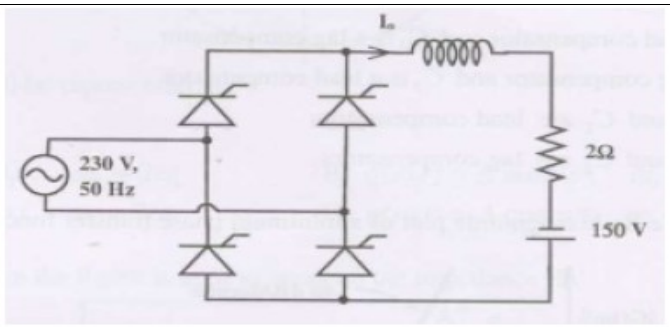
Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: Power Electronics & Drives (PSEG324) **Semester: V**
Programme: B.Tech Electrical Engg.
Time: 03 hrs. **Max. Marks: 100**
Instructions: All questions are compulsory.

SECTION A

S. No.		Marks	CO
Q 1	Enumerate the various mechanism by which thyristors can be triggered into conduction.	**4**	**CO1**
Q 2	Discuss the cause of circulating current in dual converter. Also, suggest a method to minimize the same.	**4**	**CO2**
Q 3	Give the classification of dc-dc choppers based on quadrant. Also draw relevant quadrant diagrams.	**4**	**CO3**
Q 4	'Energy flows from load to source for a fraction of the period in a 1-Φ bridge inverter." Justify.	**4**	**CO4**
Q 5	Discuss in brief the general circuit layout of a dc drive. Draw relevant diagram.	**4**	**CO3,4**
	SECTION B		
Q 6	Latching current for an SCR inserted in between a dc voltage source of 200 V and the load is 100 mA. Compute the minimum width of gate-pulse current required to turn-on this SCR in case the load consist of; (a) L= 0.2 H (b) R = 20 Ω in series with L = 0.2 H	**10**	**CO1**
Q 7	A 1-Φ fully controlled converter bridge is used for electrical braking of a separately excited dc motor. The dc motor load is represented by an equivalent circuit as shown in the figure 1. Assume that the load inductance is sufficient to ensure continuous and ripple free load current. Determine the firing angle of the bridge for a load current of I_0 = 10 A. Also draw the associated waveforms of load current & load voltage.	**10**	**CO2**

	 *Figure 1*		
Q 8	A step down dc-dc converter has a resistive load of R=20Ω and input voltage Vs= 220V. When the converter remains on its voltage drop across the switch is 1.5V and chopping frequency is 10kHz. If the duty cycle is 80%, determine a. Average output voltage b. RMS output voltage c. Converter efficiency d. Effective input resistance	**10**	**CO3**
Q 9	a. Discuss the advantages of chopper based drives over rectifier controlled drives. b. A series inverter has the following parameters: inductance L= 12mH, C= 0.1μF, load resistance R=100Ω and T_{off}= 0.3ms. Determine the frequency of the output voltage.	**5+5=10**	**CO3,4**
SECTION-C			
Q 10.	A star connected load of 15 Ω per phase is fed from 420 V dc source through a 3-phase bridge inverter. Explain the operation in 120^0 conduction mode. Also draw associated circuits and waveforms. Or For a 1-ϕ full bridge inverter Vs= 230V dc, T= 1ms. The load consists of RLC in series with R= 1Ω, X_L= 6Ω and X_C= 7Ω. a. Sketch the waveforms for load voltage v_o, fundamental component of load current i_{o1}, source current i_s and voltage across thyristor 1. Indicate devices under conduction during different intervals of one cycle. b. Find the power delivered to load due to fundamental component of current. c. Check whether forced commutation is required or not. Assume thyristor turn off time as 100μs. (10+5+5)	**20**	**CO 4**
Q 11.	a. Discuss the merits of Es /ω control over Vs/ω control. (5) b. A separately excited dc motor drives a rated load torque of 85Nm at 1200rpm. The field circuit resistance is 200Ω and armature circuit resistance is 0.2Ω. The field winding connected to 1-ϕ 400V source is fed through 1-ϕ	**20**	**CO 3,4**

	full converter with 0° firing angle. The armature circuit is also fed through another full converter from the same 1-ϕ 400V source. With magnetic saturation neglected and the motor constant is 0.8V-sec/A-rad. For ripple free armature and field currents, determine a. Rated armature current b. Firing angle delay of armature converter at rated load c. Speed regulation at full load d. Input pf of armature converter and drive at rated load. (3+3+3+6=15)		

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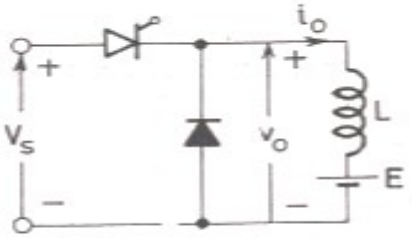
SECTION A

S. No.		Marks	CO
Q 1	Discuss the problems associated with the parallel operation of SCRs and how these are overcome.	4	CO1
Q 2	Discus in brief the need for freewheeling diode for controlled rectifier operation.	4	CO2
Q 3	Explain how a two quadrant type B chopper can be made to operate in the first and second quadrants.	4	CO3
Q 4	Justify the necessity of voltage control in a typical Voltage Source Inverter.	4	CO4
Q 5	Enlist in brief the salient features of closed loop dc drive that provides four quadrant operation with controlled rectifiers.	4	CO3,4
	SECTION B		
Q 6	Dc voltage source of 300V drives a circuit consisting of thyristor T, inductor L= 3mH, and capacitor C= 50μF in series. The circuit is initially relaxed. The thyristor is turned on at t=0. Determine: a. Conduction time of thyristor b. Voltage across capacitor after thyristor is turned off	10	CO1

Q 7	A 1-ϕ full converter bridge is connected to RLE load. The source voltage is 230V, 50Hz. The average load current of 10A is continuous over the working range. For R=0.4Ω and L= 2mH. Determine, a. Firing angle delay for E= 120V b. Firing angle delay for E= -120V For a. & b. indicate which source is delivering power to the load.	**10**	**CO2**
Q 8	The chopper circuit shown in figure below is fed from 500V dc source. For the load, L= 0.06H. For a duty cycle 0.2, find the chopping frequency to limit the amplitude of load current ripple to 10A. Also draw relevant output voltage and load current waveforms.  	**10**	**CO3**
Q 9	a. Enumerate various situations requiring braking of electrical motors. b. A 1-Φ half bridge inverter supplies a resistive load of 10Ω. If supply voltage is 200V, determine i. Rms output voltage at fundamental frequency ii. Distortion factor	**5+5=10**	**CO3,4**
	SECTION-C		
Q 10	A star connected load of 15 Ω per phase is fed from 420 V dc source through a 3-phase bridge inverter. Explain the operation in 180^0 conduction mode. Also draw associated circuits and waveforms. (OR) A 1-ϕ full bridge inverter has RLC load of R=4Ω, L=35mH and C= 155μF. The dc input voltage is 230V and output frequency is 50Hz. a. Find an expression for load current up to fifth harmonic. Also, calculate b. Rms value of fundamental load current c. Power absorbed by load and fundamental power d. Rms and peak currents of each thyristor e. Conduction times of thyristors and diodes if only fundamental component was considered. (5*4=20)	**20**	**CO4**
Q 11	a. Obtain the characteristics of a dc series motor indicating the two regions of constant torque mode and constant power mode. Also write the basic performance equations for a dc series motor drive. (8) b. A 220V 1500 rpm 10A separately excited dc motor has an armature resistance of 1Ω. It is fed from a 1-ϕ fully controlled bridge rectifier with an ac source voltage 230V, 50Hz. Assuming constant load current, determine	**20**	**CO3,4**

	i. motor speed for a firing angle of 30° and load torque of 5Nm ii. developed torque at firing angle of 45° and speed of 1000rpm. (6+6)		