Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Power Electronics & Drives **Semester: VI**
Program: B.Tech PSE **Time 03 hrs.**
Course Code: PSEG 324 **Max. Marks: 100**

Instructions: All questions are compulsory.

SECTION A

S. No.		Marks	CO
Q 1	Define reverse recovery time and gate recovery time in case of turn-off mechanism of SCR.	4	CO1
Q 2	Derive the equations for average and rms voltage of a single-phase semi converter. Assume a resistive inductive load and continuous conduction mode.	4	CO2
Q 3	Brief about constant torque drives & constant power drives.	4	CO3
Q 4	What is the purpose of connecting diodes in antiparallel with thyristors in inverter circuit. Explain how these diodes come in to play.	4	CO4
Q 5	Why stator voltage control is suitable for speed control of induction motors in fan and pump drives?	4	CO4

SECTION B

Q 6	Explain the need of commutation in thyristor circuit. What are the different methods of commutation schemes? Discuss class B commutation with a neat schematic and waveforms.	10	CO1
Q 7	A single phase transformer with secondary voltage of 230 v, 50 hz delivers power to a heater through a full wave controlled rectifier circuit. The resistance of heater is 25 Ω for a firing angle delay of 60^0 determine rectification efficiency, voltage form factor, voltage ripple factor & peak inverse voltage.	10	CO2
Q 8	A conveyer belt is placed in a Shopping Mall to carry a weight up to 1500 Kg. This belt is fed from 500 V DC source through a chopper. The motor used for motion is DC series motor. The dc motor has the following parameters: $r_a = 0.01\ \Omega$, $r_s = 0.04\ \Omega$, $K_m = 0.002$ Nm/amp^2. The average armature current of 300 A is ripple free. For a chopper duty cycle of 0.5 determine (a) input power from the source (b) motor speed and (c) motor torque	10	CO3
Q 9	For a two pulse modulation scheme, prove that a- The magnitude of n^{th} harmonic voltage is $\frac{8V_s}{n\pi}\sin n\gamma \sin\frac{nd}{2}$ b- and	10	CO4

	$\gamma = \frac{\pi - 2d}{n+1} + \frac{d}{N}$ Where N is the number of pulses per half cycle.		
	SECTION-C		
Q10	A separately excited dc motor drives a rated load torque of 85 Nm at 1200 rpm. The field current resistance is 200 Ω and armature circuit resistance is 0.2 Ω. The field winding is connected to one phase, 400 V source, is fed through 1-phase full converter with zero degree firing angle. The armature circuit is also fed through another 1-phase full converter from the same single phase, 400 V source. With magnetic saturation neglected, the motor constant is 0.8 V-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 the armature converter and the drive at the rated load	**20**	**CO3**
Q 11	A star connected heater having a per phase resistance of 2000 Ω is fed from 800 V dc source through a 3-phase bridge inverter. Explain the operation in 120^0 conduction mode with associated circuits and waveforms. Also determine the rms value of phase voltage. **OR** A three phase squirrel cage induction motor drives a blower type load. No load rotational losses are negligible. Show that rotor current is maximum when motor runs at a slip s=1/3. Find also an expression for maximum rotor current. Also determine the maximum current in terms of rated current for the motor running at (1) 1345 rpm (2) 1440 rpm.	**20**	**CO4**

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SECTION A

S. No.		Marks	CO
Q 1	Define delay time, rise time and spread time in case of turn-on mechanism of SCR.	**4**	**CO1**
Q 2	Derive the equations for average and rms voltage of a single-phase half wave controlled rectifier. Assume a resistive load.	**4**	**CO2**
Q 3	Explain why a dc series motor is more suited to deal with torque over loads than other dc motors.	**4**	**CO3**
Q 4	Define the working principle of a single phase half-bridge inverter. What is its main drawback.	**4**	**CO4**
Q 5	Deduce the basic difference between true synchronous mode and self control mode for variable frequency control of synchronous motor.	**4**	**CO4**

SECTION B

Q 6	Describe the resistance firing circuit used for triggering SCRs. Is it possible to get a firing angle greater than 90^0 with resistance firing? Illustrate your answer with appropriate waveforms.	**10**	**CO1**
Q 7	An incandescent bulb of 50 Ω is connected through a full-wave controlled rectifier circuit to 220 V, 50 Hz, single phase source. Determine a- Average output current b- RMS outut current c- The input power factor for a firing angle of 30^0.	**10**	**CO2**
Q 8	A fan is fed from a single phase semi-converter with an ac source voltage of 230 V, 50 Hz. This fan uses a separately excited DC motor of 110 V, 1000 rpm, 10 A.The dc motor has an armature resistance of 1 Ω. Assuming continuous load current, compute developed torque at the firing angle of 45^0 and speed of 1000 rpm.	**10**	**CO3**
Q 9	Describe how multiple-pulse modulated wave can be generated from carrier and reference waves. Hence show that a- Number of pulses per half cycle, $N = \frac{\omega_c}{2\omega}$	**10**	**CO4**

	b- Pulse width, $\frac{2d}{N} = \left(1 - \frac{V_r}{V_c}\right) \cdot \frac{\pi}{N}$ Where V_c and V_r are the amplitudes of carrier and reference signals respectively.		
	SECTION-C		
Q10	A 230 V, 10 KW, 1000 rpm separately excited dc motor has its armature resistance of 0.3Ω and field resistance of 300 Ω. The speed of this motor is controlled by two 3-phase full converters, one in the armature circuit and the other in the field circuit and are fed from 400 V, 50 Hz source. The motor constant is 1.1 V-s/A-rad. Armature and field currents are ripple free. a- With field converter setting to maximum field current, calculate firing angle for the armature converter for load torque of 60 Nm at rated speed. b- With the load torque as in part (a) and zero degree firing angle for armature converter speed is to be raised to 3000 rpm. Determine the firing angle of the field converter.	**20**	**CO3**
Q 11	A star connected heater having a per phase resistance of 1000 Ω is fed from 420 V dc source through a 3-phase bridge inverter. Explain the operation in 180^0 conduction mode with associated circuits and waveforms. Also determine the rms value of phase current. **OR** Explain stator voltage control method for speed control of a four pole polyphase induction motor. Determine the speed of motor if the ratio of maximum rotor current and rated rotor current is (a) 4 (b) 2. No-load rotational losses are negligible.	**20**	**CO4**