

Name:	
Enrolment No:	

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

Course: Power Electronics & Drives (ELEG 341)

Semester: VII

Programme: B.Tech Electronics Engg.

Time: 03 hrs.

Max. Marks: 100

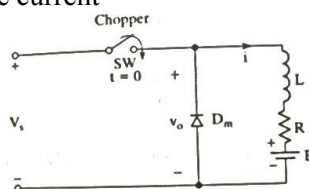
Instructions: All questions are compulsory.

SECTION A

S. No.	Question	Marks	CO
Q 1	Define latching and holding current as applicable to an SCR. Also show these currents on the static V-I characteristics.	4	CO1
Q 2	Define the terms firing angle, extinction angle and angle of overlap with reference to controlled rectifiers.	4	CO2
Q 3	Classify choppers based on quadrant operation. Give at least one application of each.	4	CO3
Q 4	Give a brief comparison of variable speed dc drives and ac drives.	4	CO3,4
Q 5	Discuss the role of an anti-parallel diode in inverter operation with inductive load.	4	CO4

SECTION B

Q 6	<p>“SCRs suffer from unequal voltage and current distribution during their turn off and turn on”. Justify.</p> <p style="text-align: center;">(or)</p> <p>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,</p> <p>(a) $L = 0.2 \text{ H}$ (b) $R = 20 \Omega$ in series with $L = 0.2 \text{ H}$.</p>	10	CO1
Q 7	A 230 V, 50Hz one pulse SCR controlled converter driving an RL load is triggered at a firing angle of $\alpha = 30^\circ$ and the load current extinguishes at an angle 210° . Calculate the circuit turn off time, average output voltage and average load current for $R = 5\Omega$ & $L = 2\text{mH}$.	10	CO2
Q 8	<p>A converter is feeding an RL load as shown in figure 1, below with $V_s = 220\text{V}$, $R = 5\Omega$, $L = 7.5\text{mH}$, $f = 1\text{kHz}$, Duty cycle (k) = 0.5 and $E = 0\text{V}$. Calculate,</p> <ol style="list-style-type: none"> minimum instantaneous load current peak instantaneous load current maximum peak to peak ripple current 	10	CO3



	<i>Figure 1</i>		
Q 9	<p>a. With reference to electrical drives, define:</p> <p>i. regenerative braking</p> <p>ii. dynamic braking</p> <p>b. Describe the operation of a single phase voltage source thyristor inverter with center tapped dc supply and resistive load.</p>	5+5=10	CO3,4
SECTION-C			
Q 10.	<p>A delta connected load of 'r' Ω per phase is fed from Vs dc source through a 3-phase bridge inverter. Explain the operation in 120⁰ conduction mode. Also draw associated circuits and waveforms.</p> <p style="text-align: center;">(or)</p> <p>Describe the working of a single phase half bridge inverter with R-L load ($X_L > R$) for all four modes of operation. Draw basic circuit model and voltage and current waveforms. Also determine the distortion factor and total harmonic distortion.</p>	20	CO4
Q 11.	<p>Discuss in detail the working of a 1-Φ drive for speed control of a separately excited dc motor. Give relevant equations and draw the fully labelled basic circuit model. Hence, enlist the factors by which speed of the motor can be controlled.</p>	20	CO3,4

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SECTION A

S. No.	Question	Marks	CO
Q 1	Discuss the need for di/dt and dv/dt protection as applicable to an SCR.	4	CO 1
Q 2	Discuss the comparative advantages of a 1- Φ rectifier and a 3- Φ rectifier.	4	CO2
Q 3	Discuss the principle of dc chopper operation.	4	CO3
Q 4	Describe the basic circuit layout of a 1- Φ dc drive.	4	CO3,4
Q 5	Enumerate the typical methods of output voltage control in an inverter for driving ac motors.	4	CO4

SECTION B

Q 6	Compare R and R-C thyristor firing circuits and discuss the function of various components used. Draw relevant circuit model. (or) For class D commutation dc source voltage is 250V, L= 20 μ H and C= 50 μ F. For constant load current I _o of 80A, determine the peak value of current through main thyristor T ₁ , capacitor and auxiliary thyristor T ₂ .	10	CO1
Q 7	A 1- ϕ full converter with 230 V, 50Hz source supplies a load consisting of R=10 Ω and a large inductance so as to render the load current constant. For a firing angle delay of 30°, and assuming $\beta > (\pi + \alpha)$, determine : <ol style="list-style-type: none"> a. Average output voltage b. Average output current c. Input power factor d. Average and r.m.s. thyristor current 	10	CO2
Q 8	Describe the working of a voltage commutated dc chopper. Draw suitable circuit mode.	10	CO3
Q 9	a. With reference to electrical drives, define: <ol style="list-style-type: none"> i. Constant torque drive 	5+5=10	CO3,4

	ii. Constant power drive b. Compare the advantages and disadvantages of voltage source inverter and current source inverter.		
SECTION-C			
Q 10	For a 3-phase bridge connected voltage source inverter with star connected load of 15Ω per phase, fed from 420 V dc source explain the operation in 180° conduction mode. Also draw associated circuits and waveforms. (OR) Describe the operation of a single phase voltage source thyristor inverter with center tapped dc supply for a. R-L load b. RLC underdamped load c. RLC overdamped load d. Purely inductive load Draw relevant circuit diagram and load voltage and current waveforms.	20	CO4
Q 11	a. Enlist the merits and demerits of half wave drives. b. Describe in detail the braking operation of a rectifier controlled separately excited dc motor. Draw suitable circuit model.	20	CO3,4