Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

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

Course: Electric Motors & Drives — **Semester: I sem**
Program: M Tech Rotating Equipment — **Time 03 hrs.**
Course Code: EPEC 7008 — **Max. Marks: 100**
Instructions: Answer all Questions

SECTION A

S. No.	**Answer all Questions**	**Marks**	**CO**
Q 1	Describe the advantages and disadvantages of AC drives	**5**	**CO1**
Q 2	A separately excited dc motor, operating from a single phase half-controlled bridge at a speed of 1600 rpm, has an input voltage of 340 sin 314t and a back emf 120V. The SCRs are fired symmetrically at $\alpha=45^0$ in every half cycle and the armature has a resistance of 2 ohms. Calculate the average armature current and the motor torque.	**5**	**CO2**
Q 3	Explain the purpose of free-wheeling diode and how it effects the dc circuit with RL load.	**5**	**CO2**
Q 4	Define latching and holding currents as applicable to an SCR. Show these currents on its static I-V characteristics.	**5**	**CO1**
	SECTION B		
Q 5	A dc chopper is used for regenerative braking of a separately excited dc motor. The dc supply voltage is 400 V. the motor r_a= 0.2 ohms, K_m= 1.2 V-s/rad. The average armature current during regenerative braking is kept constant at 300 A with negligible ripple. For a duty cycle of 60% for a chopper, determine (a) power returned to the dc supply (b) minimum and maximum permissible braking speeds.	**10**	**CO3**
Q 6	Describe regenerative braking of a chopper fed separately excited DC motor. Illustrate with circuit diagram and relevant wave forms.	**10**	**CO2**
Q 7	A 415 V, 50 Hz, 4-pole, star connected synchronous motor has X_S= 1.5 ohms. Load torque, proportional to speed is 300 Nm at synchronous speed. The speed of the motor is lowered by keeping V/f constant and maintaining 0.8 pf leading by field control. For the motor operation at 840 rpm, calculate (a) supply voltage (b) armature current (c) excitation voltage (d) load angle and € pull-out torque. Neglect rotational losses.	**10**	**CO3**
Q 8	Describe the stator frequency control for the speed control of a three-phase induction motor. Derive the expressions for motor torque and the slip at which it occurs. State the various assumptions made.	**10**	**CO2**
	(OR)		
Q 8	Discuss the effect of saturation on the speed -torque characteristics of three phase induction motor obtained by stator frequency control method.	**10**	**CO2**

SECTION-C			
Q 9	(a)Explain the two methods of speed control normally employed for DC motors. Sketch the characteristics of a separately excited DC motor based on these two methods and indicate constant- Torque drive and constant power drive. (b)A separately excited dc motor is supplied from 230V, 50 Hz source through a single-phase half wave-controlled converter. Its field is fed through single phase semi converter with zero degree firing angle delay. Motor resistance r_a=0.45 ohms and motor constant K_m= 0.55 V-sec/rad. For rated load torque of 25 Nm at 1200 rpm and for continuous ripple free currents, determine (i) Firing angle delay of the armature converter (ii) RMS value of thyristor and freewheeling diode currents (iii)Input power factor of the armature converter.	**20**	**CO4**
	(OR)		
Q 9	(a)Describe the basic performance equations for a DC series motor. Sketch the characteristics of this motor indicating the two regions of constant- Torque mode and constant power mode (b)The speed of a 20 kW, 220 V, 1000 rpm dc series motor is controlled using a single-phase half-controlled bridge converter. The combined armature and field resistance is 0.22 ohms. Assuming continuous and ripple free motor current and speed of 1000 rpm and $k=K_aC$= 0.015 Nm/A^2, determine (a) motor current (b) motor torque and (c) input power factor for a firing angle $\alpha= 45^0$. Ac voltage is 240 V.	**20**	**CO4**
Q 10	A dc battery of constant EMF 'E' is charged through a resistor in a single-phase half-controlled diode rectifier circuit for source voltage of 230V, 50 Hz and for R= 12ohms, E=115 V. (i) Find the value of average charging current (ii) Find the power supplied to battery and the dissipated in the resistor (iii) Calculate supply power factor (iv) Find the charging time in case battery capacity is 1000 Wh.	**20**	**CO4**