Ref. No.: Ex/PG/PE/T/127B/2017

M. POWER ENGINEERING EXAMINATION -2017

(2nd Semester)

SUBJECT – Advanced Electrical Drives

Time: Three hours

Full Marks: 100

Answer any ***five*** questions

Assume suitable values for missing data, if any

All parts of a question to be answered at one place

No. of Question		Marks
Q. 1. (a)	Discuss the essential parts of electrical drives. Hence explain the functions of power modulators. What are the advantages of electrical drives?	8
(b)	Discuss the performance equations of a separately excited dc motors. Hence explain the various methods of speed control of dc motors along with their torque speed characteristics.	12
2. (a)	Briefly explain the operation of a separately excited dc motor fed from a single phase full converter with the neat sketches of circuit diagram and waveforms of armature voltage, input current and load current. Consider both continuous and discontinuous motor current. Also discuss the speed torque characteristics as a function of the firing angle α .	12
(b)	An inductor is added in the motor circuit in part (a) so that motor current is now ripple free and constant. Express the input supply current in Fourier series and hence derive the expressions for input performance parameters in terms of firing angle (α).	8
3. (a)	Describe the operation of a separately excited dc motor fed from a three phase semi converter with the neat sketches of circuit diagram and waveforms of armature voltage, input current and load current. Consider both continuous and discontinuous motor voltage.	12
(b)	Derive the expression for average motor voltage for both the cases.	8
4. (a)	A 230 V, 1-ph, 50 Hz supply feeds the armature and field circuits of a separately excited dc motor through two full converters. The firing angle of the converter in the field circuit is set at a value so that the field current becomes maximum.	

	The armature and field resistances are 0.25 Ω and 200 Ω respectively. The torque and voltage constants are 1.1, the firing angle of the armature converter is 45° and the armature current is 50 A. Find the torque developed and the motor speed. Assume that the brush contact drop is 1.0 V/brush.	8
(b)	A 220 V, 1500 rpm, 50 A separately excited dc motor, with armature resistance of 0.5 ohm is fed from a three phase fully controlled converter. The available ac source has a line voltage of 440 V, 50 Hz. A star-delta transformer is used to feed the armature, so that the motor terminal voltage equals the rated voltage when the converter firing angle is zero. (a) Calculate the transformer turns ration (b) Determine the firing angle when: (i) The motor is running at 1200 rpm and rated torque. (ii) The motor is running at 800 rpm and twice the rated torque.	12
5. (a)	Describe the operation of dynamic braking control of dc motors using chopper with relevant circuit diagrams, waveforms and speed torque characteristics.	8
(b)	A separately excited dc motor is operating with Class A chopper supplied from a source voltage 110 V. The chopper is operating at 400 Hz. The motor parameters are $L_a = 0.2\ mH$ $R_a = 0.25\ \Omega$ $E_b =$ *motor back emf* $= 40\ V$ $t_{on} =$ *on period* $= 1250\ \mu sec.$ Determine (i) Whether the current is continuous or discontinuous (ii) Average motor current and voltage (iii) Maximum and minimum values of instantaneous motor current.	12
6. (a)	Describe the method of stator voltage and frequency (Volt/Hz) control employed for speed control of three phase inductor motors with relevant circuit diagrams and speed torque characteristics.	10

(b)	Describe the method of stator current control used for the speed control of induction motors. Also draw and explain the speed torque characteristics.	10
7.	Write technical notes on	
	(i) Regenerative braking control of dc motors using chopper. (ii) Static Kramer drive.	10 + 10