Ref. No.: Ex/PG/PE/T/127B/2019

M. POWER ENGINEERING EXAMINATION -2019
(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)	Briefly describe 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 discontinus motor current. Also discuss the speed torque characteristics as a function of the firing angle α.	10
(b)	For the motor in Q. 1 (a), derive the expression for critical speed which separates the continuous conduction and discontinuous conduction.	10
2. (a)	A 1-ph full converter controls the speed of a 10 HP, 1500 rpm separately excited dc motor. The rated motor current being 18 A at a particular load and the armature resistance being 0.3 Ω, find the armature voltage and back emf if ac input voltage is 230 V, 50 Hz and firing angle $\alpha = 45°$. Also, calculate the firing angle to keep the motor current at its given value if the polarity of the motor back is reversed by reversing the field excitation. What is the amount of power fed back to the supply? Assume input voltage to be 220 V.	12
(b)	A 1-ph semi converter is used for controlling the speed of a 10 HP, 220 V, 900 rpm dc series motor. The total resistance of the field and armature circuit is 0.9 Ω. Assuming continuous current and speed of 900 rpm and input supply voltage of 240 V, determine the motor current and torque for a firing angle of 45°. Assume motor constant as 0.035 Nm/A^2.	8
3. (a)	Discuss 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 discontinus motor voltage.	12
(b)	Derive the expression for average motor voltage for both the cases.	8

4.	A 1-ph, 230 V, 50 Hz, supply feeds a separately excited dc motor through two 1-ph semi converter, one for the field circuit and other for the armature circuit. The firing angle for the semi converter in the field circuit is zero. The field resistance is 200 Ω and armature resistance is 0.3 Ω. The load torque is 50 Nm at 900 rpm, the voltage constant is 0.8 V/A.rad/sec and torque constant is 0.8 N-m/A^2. Assume that armature and field currents are continuous and ripple free. Neglect the losses. Determine (i) The field current (ii) The firing angle of the semi converter in the armature circuit (iii) The power factor of the armature circuit	20
5. (a)	Describe the operation of dynamic braking control of dc motors using chopper with relevant circuit diagrams, waveforms and speed torque characteristics.	10
(b)	A separately excited dc motor is used with the help of a chopper for regenerative braking. The dc supply voltage is 440 V. The motor has R_a = *0.15* Ω, K_m = 10 V.sec/rad. The regenerative braking has a average armature current of 200 A with negligible ripple. For duty cycle of 50% for a chopper, determine (i) The power returned to the supply (ii) The minimum and maximum permissible braking speed (iii) The speed during braking	10
6. (a)	What are the different methods of speed control of three phase induction motors? Describe the operation of stator voltage control using ac voltage controller with relevant circuit diagrams and speed torque characteristics.	10
(b)	Describe the method of static rotor resistance control employed for speed control of three phase inductor motors with relevant circuit diagrams and speed-torque characteristics.	10
7.	Write technical notes on (i) Speed control of dc motors using Class A chopper. (ii) Static Kramer drive.	10+10