Code No. : 17342 S N/O

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD
Accredited by NAAC with A++ Grade
B.E. (E.E.E.) VII-Semester Supplementary Examinations, May/June-2023
Electrical Drives and Static Control (PE-II)

Time: **3 hours**

Max. Marks: **60**

Note: Answer all questions from Part-A and any FIVE from Part-B

Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	What is the difference between a constant power drive and a constant torque drive?	2	1	1	1,2
2.	Define electric drive.	2	1	1	1,2
3.	Sketch the terminal voltage and armature current waveforms of a chopper operated separately excited dc motor.	2	1	2	1,2
4.	Draw a circuit to get the motoring operation of DC motor controlled by a chopper.	2	1	2	1,2
5.	Draw the circuit diagram of a single phase semi-converter control of a separately excited DC motor.	2	1	3	1,2
6.	Sketch the speed-torque characteristics of separately excited DC motor fed from a three phase fully controlled rectifier.	2	1	3	1,2
7.	Why V/f control should be preferred over only voltage control and only frequency control? Justify.	2	1	4	1,2
8.	Discuss, why the slip-power recovery scheme is suitable mainly for drives with a low speed range?	2	3	4	1,2,3
9.	What is slew range and ramping?	2	1	5	1,2
10.	Differentiate switched reluctance motor and synchronous reluctance motor.	2	3	5	1,2,3

Part-B (5 × 8 = 40 Marks)

11. a)	Explain the closed loop speed control of electric drive with help of a block diagram.	4	2	1	1,2
b)	Discuss the factors for selection of an electric drive.	4	3	1	1,2
12. a)	Derive the expression for power regenerated by a separately excited dc motor connected to chopper during regenerative braking operation.	4	3	2	1,2
b)	With a neat circuit diagram, explain the operation of four quadrant chopper fed DC motor	4	2	2	1,2
13. a)	Derive the dynamic model of separately excited dc motor useful for speed control of dc motor drive.	4	3	3	1,2,3

		M	L	CO	PO
b)	A 220 V, 1500 rpm, 11.6 A separately excited dc motor is controlled by a 1-phase fully controlled rectifier with an AC source voltage of 230 V, 50 Hz. Enough filter inductance is added to ensure continuous conduction for any torque greater than 25% of rated torque, $R_a = 2\ \Omega$. i) What should be the value of the firing angle to get the rated torque at 1000 rpm? ii) Calculate the firing angle for the rated braking torque and -1500 rpm. iii) Calculate the motor speed at the rated torque and $\alpha = 160°$ for the regenerative braking in the second quadrant.	4	4	3	1,2,3
14. a)	Explain the speed control of a three phase cyclo-converter fed induction motor drive.	4	2	4	1,2
b)	A three-phase 400V, 6-pole, 50Hz, delta-connected slip-ring induction motor has rotor resistance of 0.2 Ω and leakage resistance of 1 Ω/phase referred to stator. When driving a fan load it runs at full load at 4% slip. What resistance must be inserted in the rotor circuit to obtain a speed of 850 rpm. Neglect stator impedance and magnetizing branch. Stator to rotor turns ratio is 2.2.	4	4	4	1,2,3
15. a)	Describe the construction and operation of a brushless DC motor.	4	2	5	1,2
b)	Write the advantages and disadvantages of stepper motor.	4	2	5	1,2
16. a)	State essential parts of electrical drives. Discuss the functions of a power modulator.	4	3	1	1,2
b)	A 250V separately excited dc motor has an armature resistance of 2.5 Ω. When driving a load at 600 rpm with constant torque, the armature takes 20 A. This motor is controlled by a chopper circuit with a frequency of 400 Hz and an input voltage of 250 V. i) What should be the value of the duty ratio if one desires to reduce the speed from 600 to 400 rpm, with the load torque maintained constant? ii) What should be the minimum value of the armature inductance, if the maximum armature current ripple expressed as a percentage of the rated current is not to exceed 10 percent?	4	4	2	1,2,3
17.	Answer any *two* of the following:				
a)	Explain in brief about the dual-converter control of dc motor. Also, derive the expression for firing angle if the dual-converter is operated in simultaneous control mode.	4	2	3	1,2
b)	Draw the circuit diagram of static Scherbius drive and explain the concept of slip recovery in brief.	4	2	4	1,2
c)	Discuss closed-loop speed control scheme for switched reluctance motor.	4	3	5	1,2,3

M : Marks;   L: Bloom's Taxonomy Level;   CO; Course Outcome;   PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	40%
iii)	Blooms Taxonomy Level – 3 & 4	40%

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