VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD

Accredited by NAAC with A++ Grade

M.E. (E.E.E.) II-Semester Main Examinations, August-2023

Power Electronics Controlled Electric Drives

(Power Systems & Power Electronics)

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.	Draw power circuit diagram of a thyristor based 3-phase full converter.	2	1	1	3,4
2.	Calculate RMS value of fundamental component of output voltage for a 3-phase inverter with DC link voltage of 500 V, operating at modulation index of 0.9.	2	4	1	3,4
3.	Draw the power circuit diagram of thyristor based 3-phase semi-converter fed separately excited DC motor Drive.	2	1	2	3,4
4.	Draw the Torque – Speed characteristics of DC shunt motor with variable DC voltage.	2	1	2	3,4
5.	Draw the torque speed characteristics of induction motor with variable voltage constant frequency power supply.	2	1	3	3,4
6.	Draw the power circuit diagram of static Kramer Drive.	2	1	3	3,4
7.	Enumerate the advantages of a microprocessor based speed controller for electric drives compared to discreet speed controller.	2	3	4	3,4
8.	List four important functions performed by microprocessor in a typical microprocessor controlled drive.	2	1	4	3,4
9.	What are the differences between BLDC and permanent magnet synchronous motor?	2	1	5	3,4
10.	What are the major differences between switched reluctance motor and stepper motor?	2	1	5	3,4

Part-B (5×8 = 40 Marks)

11. a)	Explain sinusoidal Pulse Width modulation technique for a three phase inverter with neat sketch and derive an expression for inverter output voltage.	4	2	1	3,4
b)	A three-phase full-wave semi-converter is supplied form 400 V line-to-line, 50 Hz star connected three phase power source. The output of the rectifier is connected to a highly inductive load with R = 20 Ω, calculate: (i) The load current when the firing angle α = 60°, (ii) The power drawn from the supply.	4	4	1	3,4

			M	L	CO	PO
12.	a)	Explain the operation of single phase fully controlled converter fed separately excited D.C motor drives.	4	2	2	3,4
	b)	A 30 kW, 230V, 860 rpm, 144 A DC motor has an armature resistance of 0.07 ohm. It is fed by a 3-phase fully-controlled rectifier from an AC source of 170 V (line to line), 50 Hz. Assuming continuous conduction, calculate motor speeds for the following condition. Firing Angle (α) = 600, Torque = 300 Nm	4	4	2	3,4
13.	a)	Discuss variable voltage and variable frequency control of induction motor drive with relevant equations. Sketch the speed torque characteristics for different frequencies.	4	3	3	3,4
	b)	Explain the operation of static Scherbius drive with neat schematic and relevant equations.	4	2	3	3,4
14.	a)	Explain briefly with block diagram, the functions of control blocks in a microprocessor controlled separately excited DC motor drive.	4	2	4	3,4
	b)	Explain briefly with block diagram, the functioning of a microprocessor based controller for a current source inverter fed self-controlled synchronous motor drive.	4	2	4	3,4
15.	a)	Discuss the operation and speed control aspects of a brushless DC (BLDC) motor using Hall effect sensors.	4	3	5	3,4
	b)	Define step angle for a stepper motor. Discuss briefly drive circuits for stepper motor.	4	3	5	3,4
16.	a)	Explain the function and operation of a three phase AC voltage regulator with neat circuit diagram and waveforms.	4	2	1	3,4
	b)	Discuss the operation of a chopper fed separately excited DC motors for (i) Motoring control (ii) Regenerative braking control with necessary equations.	4	3	2	3,4
17.		Answer any *two* of the following:				
	a)	Explain the working principle of Switching Reluctance Motor? List the advantages and disadvantages of switched reluctance motor.	4	2	3	3,4
	b)	Briefly discuss speed control of induction motor by static rotor resistance control with relevant equations	4	3	4	3,4
	c)	Describe the converter circuit used for switched reluctance motor and explain its operation.	4	2	5	3,4

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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