Reg.No.:												

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 8013

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – MAY / JUNE 2024
Sixth Semester
Electrical and Electronics Engineering
U19EEV21 – SOLID STATE DRIVES
(Regulation 2019)

Time: Three Hours | Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	What is meant by regenerative braking?	2	K2	CO1
2.	Sketch the speed-torque characteristics of fan-type load.	2	K1	CO1
3.	State the function of freewheeling diode in phase-controlled rectifier.	2	K1	CO2
4.	List out drawbacks of rectifier-fed DC drive.	2	K1	CO2
5.	List out the merits and demerits of stator voltage control.	2	K1	CO3
6.	Write down the consequences of increasing the frequency of induction motor without a change in the terminal voltage.	2	K1	CO3
7.	Compare sinusoidal PMAC with trapezoidal PMAC motor.	2	K3	CO4
8.	What is the need of delay circuit in open loop V/f control of synchronous motor drives?	2	K4	CO4
9.	What is the role of current limiter in the closed-loop speed control of DC drives?	2	K4	CO5
10.	Define mechanical time constant.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	Explain in detail about four quadrant operation of a hoist system.	8	K2	CO1
		ii.	What are the main factors which decide the choice of an electric drives for a given application?	5	K1	
			(OR)			
	b)		A motor operating with a suitable control system develops a torque given by the relation $T = a\omega + b$. The motor drives a load whose torque is given by the expression $T_L = c\omega^2 + d$, where a, b, c, and d are positive real constants. Find the equilibrium speeds in terms of the constants a, b, c, and d. What relation must exist between the constants for the drive to have two positive real speeds? Will the drive be stable at the equilibrium points obtained?	13	K3	CO1
12.	a)	i.	A 250- V separately excited DC motor has an armature resistance of 2.5Ω. 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. 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?	7	K3	CO2
		ii.	What are the types of control strategies in a DC chopper?	6	K4	
			(OR)			
	b)		Explain the operation of four quadrant chopper fed DC separately excited motor drive with necessary diagrams.	13	K2	CO2
13.	a)	i.	Compare VSI and CSI fed induction motor drive.	7	K4	CO3
		ii.	Highlight the features of PWM inverter fed induction motor drive.	6	K2	
			(OR)			
	b)	i.	Why is it essential to operate an induction motor between the synchronous speed and the breakdown speed when it is used to holding an active load by the regenerative braking?	6	K4	CO3
		ii.	Describe the speed control of induction motor by variable frequency supply.	7	K2	
14.	a)	i.	Discuss the advantages and disadvantages of Margin angle control.	7	K4	CO4

	ii.	A 3-phase 6600 V, 6 pole, 60 Hz, 1100 kW, Y-connected wound-field synchronous motor has the following parameters: X_m = 30 Ω, X_{sl} = 6 Ω, R_s = 1.2 Ω, field winding resistance = 5 Ω, n = 2 When operating at the rated power and unity power factor, calculate: • The field current and torque angle at full load. • The pull-out torque. • The power factor, armature current, and efficiency at half the rated torque and rated field current.	6	K3	
		(OR)			
b)	i.	Explain the power factor control of synchronous motor drives.	6	K4	CO4
	ii.	Explain the closed loop speed control of PMSM motor drive.	7	K4	
15. a)		Explain the design of speed controller for DC motor load system with inner current control and outer speed control loop.	13	K4	CO5
		(OR)			
b)		Derive the transfer function of a separately excited DC motor with armature control.	13	K2	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16. a)		Design a current controller for a small capacity constant speed drive.	15	K3	CO5
		(OR)			
b)		Compare in detail *V/f* control strategies for a small capacity constant speed drive.	15	K4	CO4