Q. Code:437594

Reg. No. | | | | | | | | | | | | | |

M.E. / M.TECH. DEGREE EXAMINATIONS, MAY 2024

Second Semester

PD22201 – ANALYSIS OF ELECTRICAL DRIVES

(Electrical and Electronics Engineering)

(Regulation 2022)

TIME:3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Analyse and design a converter for DC drive.	**4**
CO 2	Model and design a controller for DC drive.	**4**
CO 3	Design and simulate VSI and CSI fed induction motor drives.	**4**
CO 4	Expertise in the field oriented control of Induction motor drives.	**3**
CO 5	Formulate the control schemes for synchronous motor drives.	**3**

PART- A (10x2= 20Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	A 220V DC series motor having armature current as 100A drives a load with a constant torque. Find the magnitude and direction of armature current if the motor terminal voltage is reversed and the number of turns in the field winding is reduced to 80%.	**1**	**4**
2.	Identify the boundary condition between continuous and discontinuous conduction.	**1**	**3**
3.	Annotate the type of braking implemented in crane and hoist application.	**1**	**4**
4.	In a 110V DC chopper drive using the CLC scheme, the maximum possible value of the accelerating current is 300A,the lower limit of the current pulsation is 140A,find the maximum limit for current pulsation.	**1**	**4**
5.	Deduce the need for closed loop systems.	**2**	**3**
6.	Infer the need for current control loop in closed loop drive system.	**2**	**4**
7.	Negative feedback is preferred in closed loop systems. Justify the reason.	**2**	**4**
8.	Highlight the shortcomings of the analog feedback control systems.	**2**	**3**
9.	Contrast the features of Induction motor drives when compared to DC drives.	**3**	**2**
10.	Infer the consequence of rotor copper loss.	**3**	**4**
11.	Compare the reliability factor of CSI and VSI during commutation failure.	**3**	**2**
12.	Interpret the sub-synchronous mode of operation of Induction motor.	**3**	**3**
13.	Represent the complexity in the control and estimation of AC drives.	**4**	**2**
14.	Comment on the performance of direct torque control technique in Electric Vehicle	**4**	**3**

applications.

15.	Justify the need for adaptive control technique in vector controlled AC drives.	**4**	**4**
16.	Mention the need for torque observer in self-tuning control.	**4**	**3**
17.	Outline the reason for the application of synchronous motor in textile and paper mills.	**5**	**3**
18.	Illustrate the characteristic of true synchronous mode operated synchronous motor.	**5**	**3**
19.	Load commutated inverter fed synchronous motor drive is suitable for high speed and high power applications. Justify the reason.	**5**	**4**
20.	Comment on the necessity of delay unit in a open loop V/f control of synchronous motor.	**5**	**3**

PART- B (5x 14=70Marks)

		Marks	CO	RBT LEVEL
21. (a)	The speed of a 10 hp,230V,1200 rpm separately excited DC motor is controlled by a single-phase full-converter with rated armature current of 38A, armature resistance of R_a=0.3Ω. The AC supply voltage is 260V.The motor voltage constant is $K_a\phi$ = 0.182 V/rpm. Assume that sufficient inductance is present in the armature circuit to make the motor current continuous and ripple-free. For a firing angle α = 30° and rated motor current, calculate: (i) Motor torque (ii) Speed of the motor (iii) Supply power factor.	**(10)**	**1**	**4**
	(OR)			
(b)	A simple DC chopper is operating at a frequency of 2kHz from a 96V DC source to supply a load resistance of 8Ω.The load time constant is 6ms.If the average load voltage is 57.6V, find the T_{ON} period of the chopper, the average load current, the magnitude of the ripple current and its RMS value.	**(10)**	**1**	**4**
22. (a)	Derive the transfer function of DC motor with load and converter system.	**(10)**	**2**	**4**
	(OR)			
(b)	Design the speed controller with inner current controller of a separately excited dc motor.	**(10)**	**2**	**4**
23. (a)	Depict and analyse the closed loop speed control with static rotor resistance	**(10)**	**3**	**3**

control.

(OR)

(b)	Examine the speed control of a wound rotor motor operating below synchronous speed.	**(10)**	**3**	**3**

24. (a)	Demonstrate the advanced scalar control technique for voltage fed PWM inverter drives.	**(10)**	**4**	**3**

(OR)

(b)	Illustrate the direct vector control block diagram with rotor flux orientation of voltage fed inverter drives.	**(10)**	**4**	**3**

25. (a)	Enumerate the need for over-excitation of synchronous motor and implement closed loop control to maintain adequate marginal angle.	**(10)**	**5**	**3**

(OR)

(b)	Analyse and obtain the phase current and torque waveform of trapezoidal PMAC motor fed from voltage source inverter.	**(10)**	**5**	**3**

PART- C (1x 10=10Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
26.	A 2.8kW,400V,50Hz,4 pole,1370 rpm, delta connected squirrel cage induction motor has the following parameters referred to the stator. R_s=2Ω, R_r'=5Ω, X_s=X_r'=5Ω, X_m=80Ω.Motor speed is controlled by stator voltage control. When driving a fan load it runs at rated speed at rated voltage. Calculate the motor terminal voltage, current and torque at 1200 rpm.	**(10)**	**3**	**4**

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