Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree 7th semester (S,FE) Exam April 2025 (2019 Scheme)

Course Code: EET413

Course Name: ELECTRIC DRIVES

Max. Marks: 100 **Duration: 3 Hours**

PART A

Answer all questions, each carries 3 marks. Marks

1		Derive the dynamic torque equation of a motor load system.	(3)
2		Explain the different components of load torque.	(3)
3		From necessary waveforms, derive the equations of rms value of source current and power factor of a single-phase full converter drive.	(3)
4		A separately excited dc motor, operating from a single-phase half-controlled bridge at a speed of 1400rpm, has an input voltage of 330 sin 314t and a back emf 80V. The SCRs are fired symmetrically at $\alpha=30^\circ$ in every half cycle and the armature has a resistance of 4Ω. Calculate the average armature current and the motor torque.	(3)
5		With suitable circuit diagram and waveforms, explain the motoring control operation of DC Chopper drives.	(3)
6		Draw the circuit diagram of a class-C chopper fed DC motor. Also draw its V/I characteristics.	(3)
7		Explain the speed control method of induction motor with stator voltage and also state the disadvantages of this method	(3)
8		List out any three methods employed for the speed control of Induction Motor.	(3)
9		With block diagram, explain the variable frequency control of SM drive in self-control mode.	(3)
10		What are the advantages of Space Vector PWM?	(3)

PART B

Answer any one full question from each module, each carries 14 marks.

Module I

11	a)	What are the different classifications of electric drive? Give examples for each.	(4)
	b)	Explain in detail about four quadrant operation of a hoist load.	(10)

OR

12	a)	Derive the mathematical expression for steady state stability analysis of equilibrium operating point in electrical drive.	(6)

b) Derive the expressions to find the equivalent values of load torque and moment of inertia of the Electric drive system in Rotational motion. (8)

Module II

13 a) Explain the working of 3-phase fully-controlled separately excited DC drive with necessary waveforms. (8)

b) A 220V, 1500rpm, 10A separately excited dc motor has an armature resistance of 1Ω. It is fed from a single phase fully controlled bridge rectifier with an ac source voltage of 230V, 50Hz. Assuming continuous load current, compute: (6)

(i) Motor speed at the firing angle of 30˚and torque of 5Nm

(ii) Developed torque at the firing angle of 45˚and speed of 1000rpm.

OR

14 a) Explain the working of a dual converter (circulating current type) fed separately excited DC motor. (6)

b) Explain the operation of a single phase fully controlled rectifier fed separately excited DC motor with necessary waveforms. (8)

Module III

15 a) Explain the operation of four quadrant chopper fed DC drives. (10)

b) The chopper used for on-off control of a dc separately excited motor has supply voltage of 230V dc, an on time of 10msec and off-time of 15msec. Neglecting armature inductance and assuming continuous conduction of motor current, calculate the average load current when the motor speed is 1500rpm and has a motor constant of Km=0.5V/rad per sec. The armature resistance is 3Ω. (4)

OR

16 a) Explain the regenerative braking control operation of a separately excited dc motor. Also derive the equation of motor speed during regenerative braking using chopper-fed DC drives. (7)

b) A dc chopper is used for regenerative braking of a separately excited dc motor. The dc supply voltage is 400V. The motor has Ra=0.2Ω, Km=1.2Vsec/rad. The average armature current during regenerative braking is kept constant at 300A with negligible ripple. For a duty cycle of 60% for a chopper, determine: (7)

(i) Power returned to the dc supply

(ii) Equivalent load resistance of motor acting as a generator

(iii) Minimum and maximum permissible braking speeds

(iv) Speed during regenerative braking

Module IV

17 a) Explain the static rotor resistance control method for the speed control of a slip ring induction motor. What are the disadvantages of this method? (7)

b) Explain in detail, the v/f control applied to induction motor drives. (7)

OR

18 a) Explain the static Kramer scheme for the speed control of a slip ring Induction motor. (7)

b) With neat block diagram, explain the closed loop speed control of VSI fed induction motor drives. (7)

Module V

19 a) With neat diagrams, explain the concept of Space Vector Modulation. (10)

b) Explain the Clarke transformation. (4)

OR

20 a) Explain the field-oriented control (FOC) of an AC motor with a block diagram. (7)

b) With neat block diagram, explain the open loop v/f control of VSI fed synchronous motor drives. What is the need of delay circuit in open loop v/f control? (7)

****