Reg. No.																

Question Paper Code	13111

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Fifth Semester

Mechanical and Automation Engineering

20EEPW501 - ELECTRICAL DRIVES AND ACTUATORS WITH LABORATORY

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	If holding current of a thyristor is 2 mA then latching current should be (a) 0.01 A (b) 0.002 A (c) 0.009 A (d) 0.004 A	1	K2	CO1
2.	Which triggering is the most reliable? (a) Forward voltage triggering (b) Gate triggering (c) dV / dt triggering (d) Thermal triggering	1	K1	CO1
3.	SCR will be turned off when anode current is (a) < latching current but greater than holding current and gate signal is 0 (b) less than holding current (c) < latching current but greater than holding current and gate signal is present (d) both (a) and (b)	1	K1	CO1
4.	Which one is most suitable power device for high frequency (>100 KHz) switching application? (a) BJT (b) Power MOSFET (c) Schottky diode (d)Microwave transistor	1	K1	CO1
5.	What type electric drive is used in cranes? (a) Multimotor (b) Group (c) Individual (d) Both a and c	1	K1	CO2
6.	Which of the following motors is preferred for traction work? (a) Universal Motor (b) D.C. Series Motor (c) Synchronous Motor (d) Three-Phase Induction Motor	1	K1	CO2
7.	_____ drive is also called as Line shaft drive. (a) Individual drive (b) Multimotor drive (c) Group Drive (d) None of the above	1	K1	CO2
8.	Which of the following is essentially needed while selecting a motor? (a) Pulley (b) Starter (c) Foundation pedal (d) Bearings	1	K1	CO2
9.	In dc motor, the rotor is (a) Welded to the shaft (b) Keyed to the shaft (c) Soldered to the shaft (d) None of the mentioned	1	K1	CO3
10.	Sparking, is discouraged in a D.C. motor because (a) It increases the input power consumption (b) Commutator gets damaged (c) Both It increases the input power consumption and Commutator gets damaged (d) None of the mentioned	1	K1	CO3
11.	Following D.C. generator will be in a position to build up without any residual magnetism in the poles (a) series generator (b) shunt generator (c) compound generator (d) self-excited generator	1	K1	CO3
12.	Which of the following law/rule can he used to determine the direction of rotation of D.C. motor? (a) Lenz's law (b) Faraday's law (c) Coulomb's law (d) Fleming's left-hand rule	1	K1	CO3

13.	A pulse can be produce by which means? (a) Microprocessor (b) Timing Logic (c) Toggle Switch (d) All of the above	*1*	*K1*	*CO4*
14.	Which of the following is NOT an advantage of stepper motors? (a) Cost-efficient (b) Maintenance-free (c) No feedback (d) More complex circuitry	*1*	*K1*	*CO4*
15.	If a hybrid stepper motor has a rotor pitch of 36º and a step angle of 9º, the number of its phases must be (a) 4 (b) 2 (c) 3 (d) 6	*1*	*K1*	*CO4*
16.	What is the step angle of a hybrid stepper motor? (a) 0.9 degree to 3.6 degree (b) 0.9 degree to 7.0 degree (c) 0.1 degree to 1.0 degree (d) 1.0 degree to 0.9 degree	*1*	*K1*	*CO4*
17.	What type of force do linear motors produce? (a) Torque (b) Linear force (c) Centrifugal force (d) Gravitational force	*1*	*K1*	*CO5*
18.	What type of control loop is typically used in servo systems? (a) Open-loop control (b) Closed-loop control (c) Feed forward control (d) Proportional control	*1*	*K1*	*CO5*
19.	In which application would you most likely find AC servo drives? (a) HVAC systems (b) Conveyor systems (c) CNC machinery (d) Lighting systems	*1*	*K1*	*CO5*
20.	How does a VFD control motor speed? (a) By changing the mechanical load (b) By varying the motor's temperature (c) By adjusting the input frequency and voltage (d) By adding resistance in the circuit	*1*	*K1*	*CO5*

PART - B (10 × 2 = 20 Marks)

Answer ALL Questions

21.	What is meant by relay and give its types?	*2*	*K1*	*CO1*
22.	Define the term holding current and latching current.	*2*	*K1*	*CO1*
23.	List out some advantages of electric drives.	*2*	*K1*	*CO2*
24.	What are the factors that influence the choice of electrical drives?	*2*	*K1*	*CO2*
25.	What is the use of H – Bridge Motor Driver?	*2*	*K1*	*CO3*
26.	List out the applications of DC Servo Motor.	*2*	*K1*	*CO3*
27.	What is the step angle of a 4-pole stepper motor with 12 stator teeth and 3 rotor teeth?	*2*	*K1*	*CO4*
28.	Name the various driver circuits used in stepper motor.	*2*	*K1*	*CO4*
29.	Compare AC servomotor with DC servomotor.	*2*	*K2*	*CO5*
30.	Define torque angle.	*2*	*K1*	*CO5*

PART - C (6 × 10 = 60 Marks)

Answer ALL Questions

31.	a)	Explain the structure and different modes of operation with the characteristics of TRIAC.	*10*	*K2*	*CO1*
		OR			
	b)	Illustrate the basic structure of IGBT with its working. Give its equivalent circuit and explain the turn ON and turn OFF processes**.**	*10*	*K2*	*CO1*
32.	a)	An induction motor directly connected to a 400V, 50Hz supply utility has a rated torque of 30NM that occurs at speed of 2940 rpm. The motor drives a fan load that can be approximated by $T_L = B.\omega_m$ where B=0.05 Nm/rad/s, and rated speed of the motor is 3000 rpm. Stating any assumption made, show the speed, in equilibrium position at which the torque developed by the motor is equal to the load torque.	*10*	*K2*	*CO2*

OR

b) Illustrate the choice of selection of the motor for different loads. *10 K2 CO2*

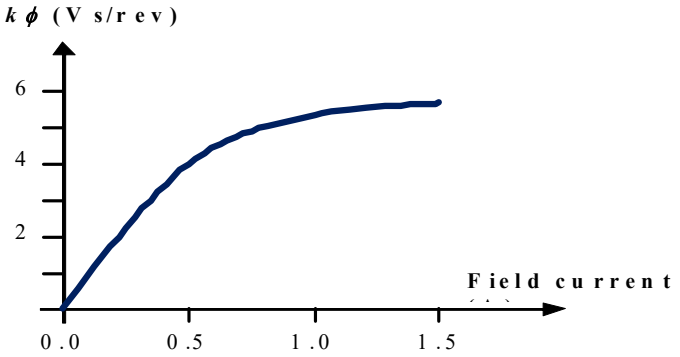
33. a) Explain the construction & operation of DC Motor. *10 K2 CO3*

OR

b) A 220V dc shunt motor has an armature resistance of 0.8Ω and field winding resistance of 220Ω. The motor field characteristic [$k\phi$ *versus* field current] is shown in figure. *10 K2 CO3*

(i) Show the field current.

(ii) If the motor drives a constant load torque of 17.5Nm, show armature current and speed.



34. a) Summarize the reluctance torque of a stepper motor. *10 K2 CO4*

OR

b) Explain the construction and operation of VR stepper motor. Also explain about micro stepping. *10 K2 CO4*

35. a) Explain the construction & operation of permanent magnet synchronous motor. *10 K2 CO5*

OR

b) Illustrate the construction & operation of linear electrical motor. *10 K2 CO5*

36. a) i) Explain the drive circuits for stepper motor and their characteristics. *5 K2 CO4*

ii) Compare AC servo motor and DC servo motor. *5 K2 CO5*

OR

b) i) Outline in detail the bipolar dives for stepper motors. *5 K2 CO4*

ii) A 5phase, 400V, 50Hz, 6pole star connected round rotor synchronous motor has Zs=0+j4Ω Load torque proportional to speed squared is 540Nm at rated synchronous speed. The speed of the motor is lowered by keeping v/f constant and maintaining unity power factor by field control of the motor. For the motor operation at 600 rpm, show a) supply voltage b) armature current c) excitation angle. *5 K2 CO5*