A **Reg. No. :** | | | | | | | | | | | | |

Question Paper Code: U6301

B.E. / B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Sixth Semester

Electrical and Electronics Engineering

21UEE601 – ELECTRIC DRIVES AND CONTROL

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. During Deceleration of a DC motor (T= Motor torque, TL =Load Torque) CO1- U

   (a) T=TL (b) T < TL (a) T=TL (b) T < TL

2. High braking torque produced in _____ CO1- U

   (a)Regenerative braking (b) Dynamic braking (c) Plugging (d) None of these

3. A DC motor operates at a voltage of 220 V and 4 A. If the voltage is reduced to 110 V, what will be the speed of the motor as a percentage of the original speed, assuming linear relationship? CO2- App

   (a) 50% (b) 60% (c) 70% (d) 10%

4. Single phase fully controlled rectifier fed separately excited dc motor operates in CO1- U

   (a) Quadrant I &II (b) Quadrant II & III (c) Quadrant I & IV (d) Quadrant III & IV

5. An induction motor is running at 380 V and 50 Hz. If the motor is operating at 60 Hz, what is the required voltage to maintain constant flux? CO2- App

   (a) 476 V (b) 416 V (b) 476 V (b) 416 V

6. A cyclo-converter fed induction motor is most suitable for which application? CO1-U

   (a) Cement mill drive (b) paper mill drive

   (c) compressor drive (d) machine tool drive

7. The maximum value of torque that a synchronous motor, can develop without losing its synchronism, is known as — CO1- U

(a) breaking torque (b) synchronizing torque (c) pull out torque (d) slip torque

8. A synchronous motor operates with an excitation voltage of 800V, terminal voltage of 600V, and synchronous reactance of 20Ω. What is the power factor? — CO2 -App

(a) 0.5 lagging (b) 0.5 leading (c) 0.8 lagging (d) 0.8 leading

9. Power modulators are used for _____. — CO1- U

(a) speed sensing (b) current sensing

(c) selecting the mode of operation (d) all the above

10. Electrical time constant Ta is_____. — CO1- U

(a) Ra *La (b) La / Ra (c) Ra/ La (d) Ra^2 La

PART – B (5 x 2= 10 Marks)

11. Analyze the factors influencing the selection of electric drives. — CO1 -U

12. Describe the purpose of a freewheeling diode in a phase-controlled rectifier. — CO1 -U

13. A three-phase induction motor operates at 400V, 50Hz with a V/f control strategy. If the frequency is reduced to 25Hz, what should be the new stator voltage to maintain constant flux? — CO2 -App

14. Identify two advantages of employing self-control in synchronous motors. — CO1 -U

15. Express the transfer function of a separately excited DC motor. — CO1 -U

PART – C (5 x 16= 80 Marks)

16. (a) Illustrate the quadrantal diagram of speed-torque characteristics for a motor driving hoist load. — CO1- U — (16)

Or

(b) (i) Describe the fundamental torque equations for a motor-load system. — CO1- U — (8+8)

(ii) Discuss in detail about steady state stability of equilibrium point in electric drive.

17. (a) Develop the single phase fully controlled converter fed separately excited dc motor drive. From the circuit operation derive the related voltage, speed and torque equations and draw the waveforms for various firing angle in continuous conduction mode. — CO2-App — (16)

Or

	(b)	A 200V, 875 pm, 150 A Separately excited dc motor has an armature resistance 0.062 Ω. It is fed from a 1-Φ fully controlled rectifier with an ac source Voltage of 220V, 50Hz. Assuming Continuous conduction, Calculate (i) Firing angle for rated motor torque & 750 rpm (ii) Fiving angle for rated. motor torque & (-500) rpm (iii) Motor speed for α=160o at rated torque.	CO2- App	(16)
18.	(a)	Apply the stator voltage control method to regulate the speed of an induction motor drive at constant frequency and variable voltage and draw its performance characteristics waveform. Discuss its advantages and disadvantages in terms of efficiency, torque control, and suitability for different applications.	CO2- App	(16)
		Or		
	(b)	Implement the low rated, varied voltage speed method to regulate the speed of an induction motor drive at a constant frequency and variable voltage. Derive the performance characteristics and illustrate the corresponding waveforms. Evaluate the method by discussing its advantages and disadvantages in terms of efficiency, torque control, and its suitability for various applications.	CO2-App	(16)
19.	(a)	Correlate the regulation of output current in a CSI-fed synchronous motor with its performance characteristics, especially in comparison to a VSI-fed motor. Analyze how commutation and harmonic distortions influence torque-speed characteristics, dynamic response, stability, power factor, and efficiency under varying load conditions.	CO4-Ana	(16)
		Or		
	(b)	Illustrate how voltage regulation in a VSI-fed synchronous motor affects its dynamic response and overall performance under fluctuating load conditions. Analyze the influence of switching frequency and PWM techniques on harmonic distortion and efficiency, and examine the impact of DC bus voltage variations on torque ripple, stability, and power factor.	CO4- Ana	(16)

20. (a) Analyze the design procedure of a proportional-integral (PI) controller for estimating the steady-state error in the current control loop of a DC drive system. Evaluate how proportional and integral gains influence transient response, stability, and steady-state error, and compare the effectiveness of a PI controller with a simple proportional controller in improving the dynamic performance of the DC drive. CO4-Ana (16)

Or

(b) Compare the performance of a DC motor speed control system using a P controller and a PI controller by analyzing key characteristics such as rise time, settling time, stability, and the effect of the integral term on system behavior. CO4-Ana (16)