Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SIXTH SEMESTER B.TECH DEGREE EXAMINATION (S), AUGUST 2023
ROBOTICS AND AUTOMATION
(2020 SCHEME)

Course Code: **20RBT304**

Course Name: **Electric Drives and Control**

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

PART A

(Answer all questions. Each question carries 3 marks)

1. Give the significance of back EMF in DC motor.
2. Define step angle of a stepper motor and calculate the stepping angle for a 3 stack, 16 tooth variable reluctance motor.
3. Define the terms holding current and latching current in terms of turn-on and turn-off times of SCR
4. Define commutation in SCR. What are the different methods of commutation?
5. What are 2 quadrant chopper drives?
6. Distinguish between continuous and discontinuous modes of single phase fully controlled converter with RL load using waveforms.
7. Differentiate between voltage source inverter and current source inverter.
8. State the cause and effects of harmonics.
9. Why do we use brushless DC motor (BLDC) and name its components?
10. Explain the operation of a Hall sensor.

PART B

(Answer one full question from each module, each question carries 14marks)

MODULE I

11. a) Derive the torque equation of a DC motor, showing the relation with flux and armature current. (7)
    b) Draw and explain the closed loop speed control scheme widely used in stepper motors. (7)

OR

12. a) With a neat block diagram, explain the operation of DC servo motor. (7)
    b) State the reason for using starters in DC motors? Explain 3-point starter in detail with neat diagram. (7)

MODULE II

13. a) Explain in details the construction and working of IGBT. (5)

b) Draw the V-I characteristics of a thyristor and explain its different operating regions. What is the effect of Gate current on the V-I characteristics of a thyristor? (9)

OR

14. a) Draw the switching characteristics of power MOSFETs. Define turn-on delay time, rise time, turn-on time, turn-off delay time, fall time, and turn-off time. (7)

b) What are the different turn–on methods of a thyristor? Explain any three methods. (7)

MODULE III

15. a) Explain the working of single-phase full wave bridge rectifier circuit with RLE load. (9)

b) A single-phase full converter feeds power to RLE load with R=8Ω, L=8mH and E=46.42V, the ac source voltage is 230V,50Hz for continuous conduction. Find the average value of load current for a firing angle delay of 45 degrees. (5)

OR

16. a) With a neat circuit diagram and waveforms, illustrate the operation of a step-up chopper. Derive the output voltage equation. (9)

b) Explain how regenerative braking of a DC motor is done by chopper control. (5)

MODULE IV

17. a) Explain how variable frequency drive (VFD) is used in motor control. List out some of its merits. (6)

b) Explain in detail the operation of a three-phase bridge inverter at 120-degree conduction angle. (8)

OR

18. a) Explain with circuit diagram and waveforms, the operation of a single-phase full bridge inverter with RL load. (8)

b) With neat circuit diagrams explain the operation of a single-phase full bridge inverter with R load. (6)

MODULE V

19. a) Illustrate the working of a 3-phase brushless DC motor in detail. (8)

b) Compare exterior and interior permanent magnet synchronous motor. (6)

OR

20. a) Explain how position control is achieved in servo control system. (7)

b) Explain about sensor-less control of BLDC motor. (7)

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