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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SIXTH SEMESTER B.TECH DEGREE EXAMINATION (R), MAY 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. Explain the necessity of starters in dc motors.
2. Describe the dynamics of motor-load system using fundamental torque equation.
3. Describe the structure of a power diode.
4. Compare natural and forced commutation in an SCR.
5. Describe the working of a step-up chopper with circuit diagram and waveforms.
6. A single-phase full-wave fully-controlled bridge rectifier is supplying highly inductive load. The r.m.s value of the a.c. input voltage is 230V.The firing angle is maintained constant at 45^0 so that the load current is continuous at a value of 5A. Calculate the dc output Voltage.
7. With block diagram explain variable voltage variable frequency drive.
8. List the advantages of a single-phase voltage source inverter.
9. Explain the closed loop control of stepper motor.
10. Describe the self-control mode of operation of PMSM.

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

MODULE I

11. a) Explain the construction and principle of operation of permanent magnet stepper motor.   (7)
    b) Describe the working of AC servomotors.   (7)

OR

12. a) Illustrate the 3-point starter in a dc motor.   (8)
    b) Explain the speed-torque characteristics of a DC series motor.   (6)

MODULE II

13. a) Explain the switching characteristics of an SCR.   (9)

b) Describe the V-I characteristics of a power MOSFET. (5)

OR

14. a) List the turn-on methods of SCR and explain any two methods. (6)
    b) Illustrate the switching characteristics of power BJT. (8)

MODULE III

15. Graphically explain the single phase fully controlled bridge converter circuit with RL load under continuous and discontinuous conduction mode. (14)

OR

16. a) Explain a 2-quadrant chopper with output voltage waveforms. (7)
    b) Describe the regenerative braking operation of a chopper-controlled DC drive. (7)

MODULE IV

17. a) Explain 3-phase bridge inverter with R load and 180^0 conduction mode with waveforms and equations. (10)
    b) Justify how harmonics are eliminated using pulse width modulation. (4)

OR

18. a) Explain the working of a single-phase full bridge voltage source inverter with R load. (8)
    b) Compare single pulse width and multiple pulse width modulation in inverters. (6)

MODULE V

19. a) Explain the method of speed control in BLDC motors using hall effect sensors. (9)
    b) Illustrate the operation of a microcontroller based permanent magnet synchronous motor drives. (5)

OR

20. a) Describe the full step and half step mode of operation of variable reluctance stepper motor drive circuit. (12)
    b) List the advantages and applications of BLDC motor drive circuit. (2)

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