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Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Sixth Semester B.Tech Degree Regular and Supplementary Examination June 2023 (2019 Scheme)



**Course Code: RAT304**

**Course Name: ELECTRIC DRIVES AND CONTROL**

**Max. Marks: 100**

**Duration: 3 Hours**

**PART A**

*Answer all questions, each carries 3 marks.*

Marks

- |    |   |     |
|----|---|-----|
| 1  | Describe the block diagram of an electric drive system                                  | (3) |
| 2  | Explain the necessity of starter in dc motor  | (3) |
| 3  | Explain (i) Latching current and (ii) holding current of an SCR                         | (3) |
| 4  | Compare line commutation and load commutation of an SCR                                 | (3) |
| 5  | Explain the operation of chopper in step up mode  | (3) |
| 6  | Explain the armature control method for speed control of DC motor drives                | (3) |
| 7  | Describe the impact of harmonics in inverters   | (3) |
| 8  | Briefly explain sinusoidal PWM  | (3) |
| 9  | Describe the working of DC Servomotors  | (3) |
| 10 | Explain the working of microcontroller based permanent magnet synchronous motor drives. | (3) |

**PART B**

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

**Module I**

- |    |  |     |
|----|--|-----|
| 11 | a) Describe the different components of load torque ( $T_l$ ) with equations | (6) |
|    | b) Explain the construction and working of Permanent Magnet Stepper Motor    | (8) |

**OR**

- |    |   |     |
|----|---|-----|
| 12 | a) Illustrate the working of a 3-point starter used in dc motor | (8) |
|    | b) Explain the characteristics of dc series motor with figure   | (6) |

**Module II**

- |    |  |      |
|----|--|------|
| 13 | a) Illustrate the V-I characteristics and switching characteristics of an IGBT | (10) |
|    | b) Explain the structure of a Power MOSFET                                     | (4)  |

**OR**

- 14 a) Explain the different turn-on methods of SCR (7)  
 b) Discuss the need of isolation in power semiconductor switching circuits (7)

**Module III**

- 15 a) Illustrate the operation of a single phase fully controlled bridge rectifier with RL load in continuous conduction mode. (8)  
 b) Describe the operation of a two-quadrant chopper (6)

**OR**

- 16 a) A single-phase controlled full-wave rectifier, has a source of 220 V r.m.s at 50 Hz, and is feeding a load  $R = 20 \Omega$  and  $L = 40 \text{ mH}$ . The firing angle is a  $45^\circ$  and the extinction angle is,  $\beta = 230^\circ$ . (6)  
 (i) Specify whether the current is continuous or discontinuous  
 (ii) Determine the average output voltage and current.  
 b) Explain the rectifier mode of operation of a single phase fully controlled converter fed dc motor drive (8)

**Module IV**

- 17 a) With circuit diagram and waveforms explain 3-phase bridge inverter with R load and  $120^\circ$  conduction mode. (10)  
 b) Compare the different voltage control methods in inverters (4)

**OR**

- 18 a) Describe the working of single phase full bridge Voltage Source Inverter with R-load using circuit diagram and waveforms (8)  
 b) Explain any one method to eliminate the effects of harmonics from inverters (6)

**Module V**

- 19 a) Explain how power electronic converter circuits are used in BLDC motor for speed control. (8)  
 b) Explain self control in PMSM (6)

**OR**

- 20 a) Describe the single phase ON mode and two-phase ON mode of operation of variable reluctance stepper motor (8)  
 b) Illustrate any one application of dc servomotor (6)

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