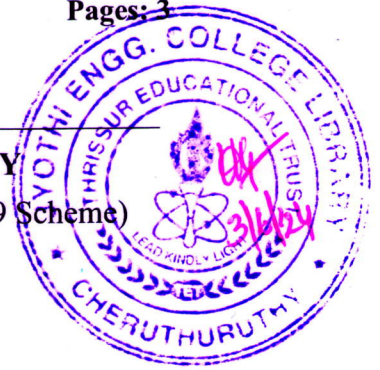


Reg No.: \_\_\_\_\_

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

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

B.Tech Degree S6 (R,S) / S4 (PT) (R,S) Examination May 2024 (2019 Scheme)

**Course Code: EET306****Course Name: POWER ELECTRONICS**

Max. Marks: 100

Duration: 3 Hours

Graph sheet may be provided

**PART A***Answer all questions, each carries 3 marks.*

Marks

- |    |  |     |
|----|--|-----|
| 1  | Sketch the static VI characteristics of SCR and define latching current and holding current.   | (3) |
| 2  | Mention the advantages of wide band-gap power devices  | (3) |
| 3  | Draw the circuit & output voltage waveform of a single half wave controlled rectifier.   | (3) |
| 4  | Compare single phase full bridge converter and single phase semi converter   | (3) |
| 5  | Explain the working of a single phase full bridge voltage source inverter with pure R load. Draw the output voltage waveform.  | (3) |
| 6  | Write a short note on THD.   | (3) |
| 7  | In a step up chopper the dc input voltage is of 100V. The MOSFET switch is having a switching frequency of 1kHz. Find the duty cycle and average dc output voltage if the turn on period of switch is 0.2ms. | (3) |
| 8  | Draw the waveform of inductor voltage of a buck dc-dc converter and obtain an expression for output dc voltage in terms of input voltage and duty cycle  | (3) |
| 9  | Explain with relevant curves components of frictional load torque  | (3) |
| 10 | Explain regenerative braking control in drives   | (3) |

**PART B***Answer one full question from each module, each carries 14 marks.***Module I**

- |           |  |     |
|-----------|--|-----|
| 11        | a) With the help of a diagram, explain the Two Transistor analogy of an SCR, with necessary equations. | (8) |
|           | b) Explain the structural features of power MOSFET with a neat sketch                                  | (6) |
| <b>OR</b> |  |     |
| 12        | a) Explain the mechanism of turning-on an SCR using its Turn-on characteristics.                       | (8) |
|           | b) Explain how di/dt and dv/dt protection is accomplished in SCR.                                      | (6) |

**Module II**

- 13 a) Illustrate how a Thyristor based 1-phase fully controlled rectifier can be used to convert ac into variable dc. Draw the waveforms of output voltage, voltage across the thyristors & output current for both R and RL load at  $\alpha=30^\circ$  (8)
- b) Obtain an expression for average dc output voltage of a 1-phase fully controlled rectifier for R load with firing angle  $\alpha$ . For an sinusoidal AC input of 220 V rms at 50 Hz and a 20 ohm load resistor and delay angle is  $40^\circ$  Determine the average current in the load, (6)

**OR**

- 14 a) With the help of circuit diagram and relevant waveforms, explain the working of three phase fully controlled bridge converter, feeding RL load, with firing angle  $60^\circ$ . (10)
- b) What is the use of free-wheeling diode in the single-phase half wave converter feeding RL load? Explain the change in voltage waveform due to free-wheeling diode. (4)

**Module III**

- 15 a) Describe the operation of single phase AC voltage controller for R load with waveforms and derive expression for output rms voltage. (6)
- b) Illustrate the generation of sine pulse width modulated control signals for a single phase VSI with output voltage waveform. (8)

**OR**

- 16 Explain the operation of a 3-phase voltage source inverter with  $180^\circ$  mode of operation. Draw the phase voltages and line voltages across a star connected R load. (14)

**Module IV**

- 17 Describe the working of 4 quadrant choppers with proper circuit diagram and relevant waveforms (14)

**OR**

- 18 With circuit diagram and waveforms, describe the operation of a buck-boost dc-dc converter. Derive expressions for output dc voltage and the design equations for filter inductor & capacitor. (14)

**Module V**

- 19 a) What are the advantages of electric drives (6)
- b) Explain the working of a single phase full converter drive (8)

OR

- 20 a) Explain the parts of electric drive with its block diagram (7)
- b) Why the stator voltage control for Induction motor drive has low efficiency? (7)
- Explain with relevant equations. Also draw the circuit diagram

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