

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth semester B.Tech degree examinations (S) September 2020

Course Code: EE305**Course Name: POWER ELECTRONICS**

Max. Marks: 100

Duration: 3 Hours

*Graph sheets will be provided***PART A***Answer all questions, each carries 5 marks.*

Marks

- | | | |
|---|---|-----|
| 1 | Draw the static VI characteristics of a SCR and explain. | (5) |
| 2 | Explain R firing circuit of SCR with circuit diagram and waveforms. | (5) |
| 3 | Draw the output voltage waveform of a 3-phase controlled half wave rectifier for $\alpha=30^\circ$. | (5) |
| 4 | Explain the working of a single phase half bridge voltage source inverter with pure R load. Draw the output voltage & output current waveforms and derive an expression for rms output voltage. | (5) |
| 5 | For a single phase ACVC with source voltage $asv_s = 100\sin\omega t$, and load $asR = 50\Omega$, draw the output voltage and current waveforms if Thyristor firing angle is (i) $\alpha=30^\circ$ (ii) $\alpha=90^\circ$. | (5) |
| 6 | Define the terms amplitude modulation index and frequency modulation index. | (5) |
| 7 | Draw the waveform of inductor voltage of a boost dc-dc converter and obtain an expression for output dc voltage in terms of input voltage and duty cycle. | (5) |
| 8 | In a step down chopper the dc input voltage is of $100V$. The MOSFET switch is having a switching frequency of $2kHz$. Find the duty cycle and average dc output voltage if the turn on period of switch is $0.2ms$. | (5) |

PART B*Answer any two full questions, each carries 10 marks.*

- | | | |
|----|---|------|
| 9 | Deduce the Two Transistor Model for a Thyristor and explain the Thyristor operation using this model. | (10) |
| 10 | a) Describe the variation of current and voltage during turn- on time of an SCR with the help of characteristics. | (5) |
| | b) With circuit diagram and relevant waveforms, explain the operation of UJT firing circuit for triggering a SCR. | (5) |

- 11 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 & output current for both R and RL load at $\alpha=30^\circ$. (6)
- b) Obtain an expression for average dc output voltage of a 1-phase fully controlled rectifier for R load with firing angle, α . (4)

PART C

Answer any two full questions, each carries 10 marks.

- 12 Describe the operation of a 3-phase semi-converter with RLE load having constant output current when firing angle is 30° with output voltage waveform and derive an expression for average dc output voltage. (10)
- 13 a) Explain how four quadrant operation is possible using a 1-phase dual converter operating in both circulating and non-circulating current modes. (5)
- b) A 50Hz single phase full bridge square wave inverter is fed from 500V dc input. Find output rms voltage and current for a load of $R=5\Omega$ and $L=10\text{mH}$. (5)
- 14 Illustrate the operation of a 3-phase bridge inverter operating in 180° conduction mode with output line voltage and phase voltage waveforms. Derive expressions for output line voltage and phase voltage. (10)

PART D

Answer any two full questions, each carries 10 marks.

- 15 Illustrate the generation of sine pulse width modulated control signals for a single phase VSI with output voltage waveform. (10)
- 16 a) Describe the operation of single phase AC voltage controller for R load with waveforms and derive expression for output rms voltage. (5)
- b) For a dc-dc buck-boost converter with a dc input voltage of 50V and output voltage of 100V, calculate (i) duty cycle (ii) value of inductor if inductor ripple current $\Delta I = 10\text{mA}$. Given the switching frequency is 10kHz (5)
- 17 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. (10)
