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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 $\alpha=30^0$. (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 as$v_s = 100sin\omega t$, and load as$R = 50\Omega$, draw the output voltage and current waveforms if Thyristor firing angle is (i) $\alpha=30^0$ (ii) $\alpha=90^0$. (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 $\alpha=30^0$. (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 30^0 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 form 500V dc input. Find output rms voltage and current for a load of R=5Ω and L=10mH. (5)

14 Illustrate the operation of a 3-phase bridge inverter operating in 180^0 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 ΔI =10mA. 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)

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