Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: EE305

Course Name: POWER ELECTRONICS (EE)

(Graph sheets to be permitted)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks Marks

1 "A thyristor can be triggered by an external gate pulse"- Justify using two transistor analogy of thyristor. (5)

2 Explain how the firing angle of an SCR can be varied by using a UJT relaxation oscillator. (5)

3 What is the role of freewheeling diode in a 3 phase semi-converter? (5)

4 Compare voltage source and current source inverters. (5)

5 What is sequence control in single phase ac voltage controllers? What are the advantages of employing it? (5)

6 Explain sine PWM technique, with relevant waveforms. Define modulation index and mention its significance. (5)

7 A type A chopper has input voltage of 200 V. The current through a load of R=10Ω in series with L=80 mH, varies between 12 A and 16 A. Find the form factor of the output voltage waveform. (5)

8 Design a dc-dc converter with 12 V input and 200 V output at up to 50W. The ripple in the output voltage and input current should not exceed ±5% and ±20% respectively. Choose an appropriate switching device and frequency. (5)

PART B

Answer any two full questions, each carries 10 marks

9 a) With neat sketches, explain the static V-I characteristics of an SCR. Define latching and holding current. (6)

b) Two thyristors having a difference of 4 mA in latching current are connected in series. The voltage across the devices are 500 V and 480 V. Calculate the derating factor and thestatic equalizing resistance value for maximum string efficiency. (4)

10 a) Compare Thyristor, Power MOSFET and IGBT on the basis of following parameters: (5)

i) Switching frequency ii) Voltage and current ratings

iii) Applications (at least two)

b) Compare the maximum power that can be handled by fully controlled rectifier in mid-point and bridge configuration if the firing angle is 30º and the reverse voltage rating (peak) of the thyristors is 200V. (5)

11 a) Explain a half-wave controlled rectifier feeding RL load, with waveforms of output voltage and output current. Derive the expression for average output voltage. (6)

b) A single phase semi-converter fed from 120 V, 50 Hz supply is connected to a load resistance of 10 Ω. If the average output voltage is 25% of its maximum possible average output voltage, find the circuit turn off time. (4)

PART C

Answer any two full questions, each carries 10 marks

12 a) Draw the circuit for three phase full converter feeding RLE load. Sketch the output voltage waveform for a firing angle of 60^0. (6)

b) A three-phase half-wave controlled converter is connected to 380 V (line) supply. If the load current is constant at 32 A independent of the firing angle and on state forward drop of SCRs is 1.2 V, Find: (4)
i) Peak reverse voltage rating of SCRs
ii) Average power dissipation in each SCR

13 a) Explain the basic working of an ideal Dual converter and its four-quadrant operation. (6)

b) A single-phase half bridge inverter has a resistive load of 10 Ω, and a center-tap dc input voltage of 96 V. Obtain the Fourier series representation of the output voltage waveform and hence find the value of distortion factor. (4)

14 Explain the 120^0conduction mode of a three-phase bridge inverter with output voltage waveforms, indicating the devices conducting in each state. (10)

PART D

Answer any two full questions, each carries 10 marks

15 a) Explain the operation of single phase voltage controller with RL load with output voltage and current waveforms. (6)

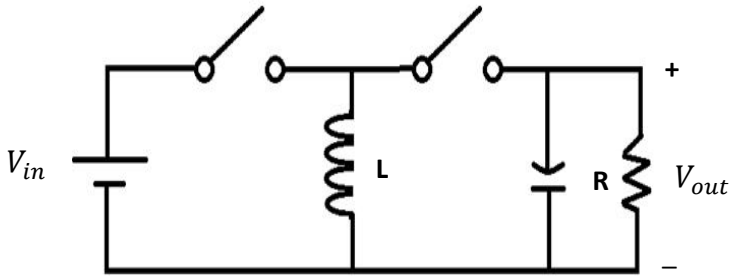
b) For a single-phase voltage controller, develop a relationship between conduction angle and firing angle. Under what condition conduction angle equals π? (4)

16 a) Design a simple light dimmer circuit using TRIAC including the trigger circuit. (4)

b) Explain the working of Two quadrant (Class C) chopper, with relevant waveforms. (6)

17 a) Derive the expression for output voltage of a Buck-Boost regulator, showing relevant waveforms. (6)

b) The switches in the figure are operated alternatively, each switch being on for half of each cycle. Determine the relationship between V_{in} and V_{out} . (4)



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