Code: 13A02503 **R13**

B.Tech III Year I Semester (R13) Regular & Supplementary Examinations November/December 2016

POWER ELECTRONICS

(Electrical & Electronics Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Sketch static VI characteristics of SCR and define the terms Latching current and Holding current.

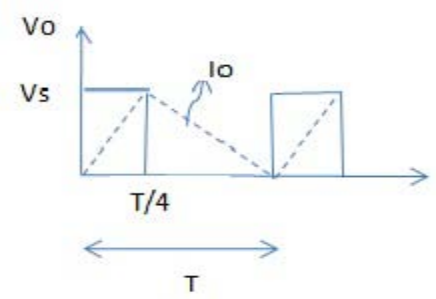
(b) Illustrate UJT firing circuit and discuss its features.

(c) Discuss the effect of source and load inductances on the performance of a single phase rectifier.

(d) Write the operational differences between circulating and non-circulating current modes of a single phase dual converter with resistive load.

(e) Compare various control strategies of a Chopper.

(f) Find the duty cycle and average output voltage of the following waveform.



(g) Draw the schematic circuital representation and output voltage waveform of a single phase parallel inverter, assuming that the transformer turns ratio between secondary and primary half is unity.

(h) A single phase half bridge Inverter has a resistive load, R = 10 ohms and the DC input supply voltage, V_s = 100 V. Obtain RMS output voltage at fundamental frequency.

(i) For a single phase AC Voltage controller with resistive load, R = 100 ohms, obtain RMS output voltage when supplied from 230 V, 50 Hz single phase source and fired at 65^o.

(j) Identify the changes to be done for making a single phase midpoint type step-up cycloconverter circuit to operate as a step down cycloconverter.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) List the differences between various Power Transistors and also describe the advantages of Power Transistors over Thyristors.

(b) By using two transistor analogy of SCR, justify the statement “Gate current loses control over the conduction of SCR once the SCR starts conducting”.

OR

3 (a) Discuss the consequences and remedies of a method that increases the current rating of a string formed by the combination of several SCRs.

(b) Determine the number of SCRs to be connected in a:
(i) Series string with a total voltage of 5 kV.
(ii) Parallel string with a total current of 1500 A.
Consider the voltage and current rating of each SCR as 800 V and 100 A respectively and de-rating factor as 15%.

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UNIT – II

4 (a) Explain the operation of a single phase semi-converter with RL load and sketch the associated waveforms.

(b) What is an extinction angle? List the factors affecting extinction angle.

OR

5 (a) Derive an expression for average output voltage of a three phase six pulse Rectifier with R-load.

(b) A fully controlled single phase Rectifier is supplied at 230 V, 50 Hz. The supply source inductance is 3mH. Neglecting resistance voltage drop, obtain the overlap angle when the rectifier is operating at a firing angle of 30^o and supplying a load current of 10 A. Determine also the load voltage.

UNIT – III

6 (a) With the help of a neat circuit diagram and associated waveforms, explain the operating principle of Class-D commutation technique.

(b) Discuss how the output voltage of a step-up chopper can be varied beyond the level of source voltage.

OR

7 (a) Analyze the performance of a step-down chopper with RLE-load and obtain the expressions for instantaneous current.

(b) Discuss the current limit control strategy of a Chopper.

UNIT – IV

8 (a) Explain the operation of basic series Inverter and state its limitations.

(b) Calculate the output frequency of a basic series Inverter with the following parameters: L = 10 mH, C = 0.4 μF, R= 300 ohms and T_{off} = 0.2 ms.

OR

9 Explain how a single phase half bridge Voltage Source Inverter, with RL-load, supplied by a fixed DC source will produce an alternating output voltage? Also derive an expression for instantaneous output voltage produced.

UNIT – V

10 Discuss the operation of a single phase AC voltage controller with RL load for firing angle α greater than load phase angle, ϕ. Also show that, for α less than ϕ, the output voltage of AC voltage controller cannot be regulated.

OR

11 (a) Discuss the basic philosophy behind TRIAC construction.

(b) Explain the operation of a single phase bridge type Cycloconverter with RL-load producing an output frequency 1/3 times that of source frequency. Also sketch the relevant output waveforms.

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