

M. Tech.

ADVANCED POWER ELECTRONICS

SUBJECT CODE : PEE - 503 / ELE - 503

Paper ID : [E0483]

[Note : Please fill subject code and paper ID on OMR]

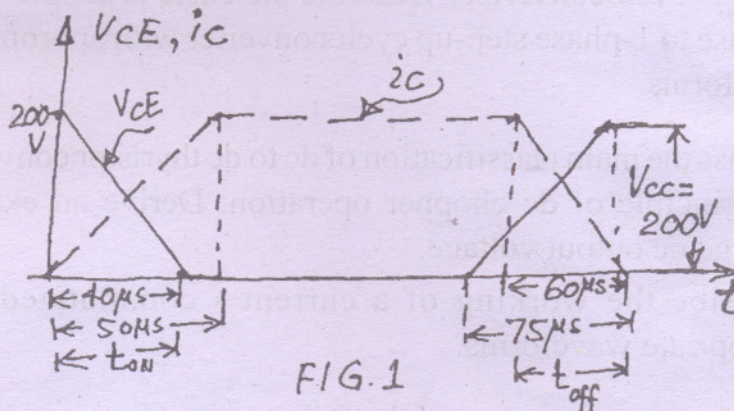
Time : 03 Hours

Maximum Marks : 100

Instruction to Candidates:

- 1) Attempt any Five questions.
- 2) All questions carry equal marks.

- Q1) (a) Describe Reverse recovery characteristics of Diodes. Show that reverse recovery time and peak inverse current are dependent on storage charge and rate of change of current.
- (b) A diode is connected in series with RC- Load. The capacitor is initially charged with V_0 . Determine the expressions for current in the circuit and voltage across capacitor. Sketch the waveforms for the current as well as capacitor voltage.
- Q2) (a) A power transmitter has its switching waveforms as shown in Fig 1. If the reverse power loss in the transistor is limited to 300W, obtain the switching frequency at which the transistor can be operated.



- (b) What is IGBT? What are its other names? Give its basic structural features and describe its working.
- Q3) (a) For an SCR, gate cathode characteristics is given by, $V_g = 1 + 10 I_g$. Gate source voltage is a rectangular pulse of 15V with 20 μ s duration. For an average gate power dissipation of 0.3W and a peak drive power of 5W, compute.

- i) the resistance to be connected in series with the SCR gate.
- ii) the triggering frequency and.
- iii) the duty cycle of the triggering pulse.

(b) Explain the need of commutation in thyristor circuits. What are different methods of commutation schemes? Discuss one of them, involving two thyristors, with a neat schematics and waveforms.

Q4) (a) Define string efficiency for series connected SCRs. Show that string efficiency of two series connected SCRs is usually less than one. Derive an expression for the resistance used for static voltage equalization for a series connected string.

(b) It is required to operate 250A SCR in parallel with 350A SCR with their respective on-state voltage drops of 1.6V & 1.2V. Calculate the value of resistance to be connected in series with each SCR so that they share the total load of 600A in proportional to their current ratings.

Q5) (a) Describe the working of 3-phase full converter with RLE - load. Illustrate your answer with voltage waveforms and conduction of thyristors.

(b) Discuss the effect of source impedance on the performance of a single-phase full converter indicating clearly the condition of various thyristors during one cycle.

Q6) (a) What is an ac voltage controller? List some of its industrial applications. Draw the possible configurations of 1-phase voltage controller of 1-phase voltage controller and compare them.

(b) What is cycloconverter? Describe the basic principle of working of a 1-phase to 1-phase step-up cycloconverter with appropriate circuit and waveforms.

Q7) (a) Discuss the main classification of dc to dc thyristor converters. Describe the principle of dc chopper operation. Derive an expression for its average dc output voltage.

(b) Describe the working of a current - commutated chopper with appropriate waveforms.

Q8) Write short notes on any two of the following :

(a) Thyristor protection.

(b) 1-phase bridge inverters.

(c) Modified McMurray full-bridge inverter.

