CBCS SCHEME

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18MT62

Sixth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Power Electronics

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Define power electronics, list the applications of power electronics. **(10 Marks)**

b. With necessary waveform and diagram, explain the switching characteristics of power BJT and power MOSFET. **(10 Marks)**

OR

2 a. Write the symbol and control characteristics of following power devices.
i) SITH ii) SCR iii) MCT iv) GTO v) IGBT. **(10 Marks)**

b. Name the types of power electron converters and explain briefly. **(10 Marks)**

Module-2

3 a. With waveform explain switching characteristics of power Thyrisotr (SCR) mention its different mode of operation. **(10 Marks)**

b. Explain two transistor model of SCR and derive the expression for anode current

$$I_A = \frac{\alpha_2 I_G + I_C B01 + I_C B02}{1+(\alpha_1+\alpha_2)}$$ **(10 Marks)**

OR

4 a. An SCR having a turn on times of 5 μsec, latching current of 50 mA and holding current of 40 mA is triggered by a short duration pulse and is used in the circuit shown in Fig Q4(a). Calculate the minimum pulse width required to turn on the SCR. **(10 Marks)**

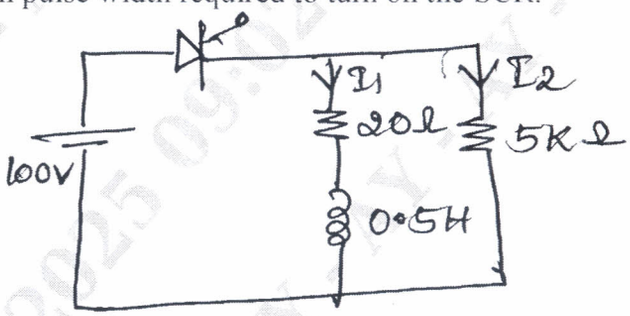

Fig Q4(a)

b. With necessary circuit diagram and waveform, explain class D commutation. **(10 Marks)**

Module-3

5 a. With waveform and necessary diagram, explain the working ON-OFF controller, drive expression for RMS output voltage and average output voltage. **(10 Marks)**

b. Explain single phase Bidirectional controller with R load. Give necessary waveforms and diagram. Write RMS output voltage and average output voltage expressions. **(10 Marks)**

OR

6 a. The single phase full wave AC voltage controller has a resistive load of R = 10 Ω. The input R_1' Vs =120V (rms), 60 Hz. The delay angle of Thyrsisted T_1 and T_2 are equal to $\alpha_1 = \alpha_2 = \pi/2$. Calculate :
i) Rms value of o/p voltage ii) Average current through thyristor iii) rms current of thyristors iv) the input power factor **(10 Marks)**

b. The fully controlled thryristor converter in the Fig Q6(b) is fed from a single phase source. When the firing angle is 0° the dc output voltage of the converter is 300V. Calculate the output voltage for a firing angle of 60°, assuming continuous conductors is **(10 Marks)**

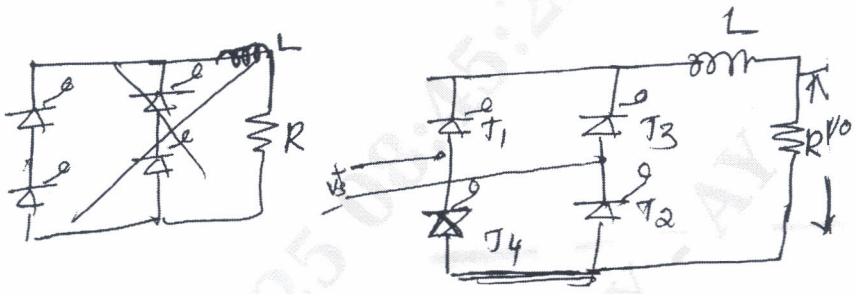

Fig Q6(b)

Module-4

7 a. Explain the principle of operation of a step up chopper. **(10 Marks)**

b. A voltage commutated thyristor chopper circuit is shown in Fig Q7(b).The chopper is operated at 500Hz with 50% duty rate. The load takes a constant current of 20A.

i) Evaluate the circuit turn off time for the main thyristor Th

ii) Calculate the value of L_1 if peak current through main thyristor Th is limited to 180% of load current

iii) Calculate maximum instantaneous output voltage of chopper.

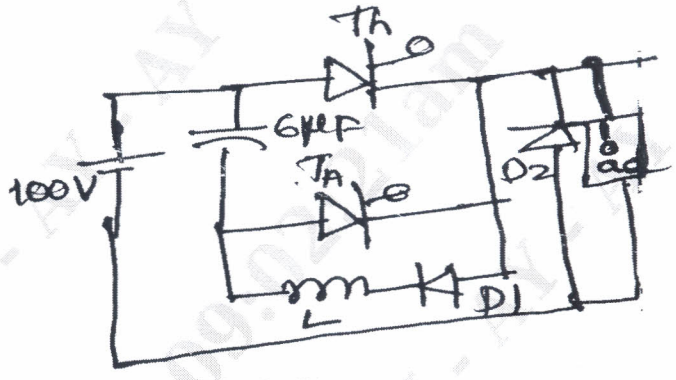

Fig Q7(b) **(10 Marks)**

OR

8 a. Give the classification of chopper and explain them. **(10 Marks)**

b. Explain the working principle of impulse commuted thyristor chopper with necessary circuit diagram and wavefroms. **(10 Marks)**

Module-5

9 a. Explain the principle of single phase half bridge inverter with relevant circuit diagram and waveform. **(10 Marks)**

b. Explain :

i) Total harmonic distortion

ii) Distortion factor

iii) Harmonic factor of n^{th} harmonic related to an inverter. **(10 Marks)**

OR

10 a. With relevant circuit diagram and waveform explain 3-phase inverter. **(10 Marks)**

b. Compare voltage source inverter and current source inverter. **(10 Marks)**

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