CBCS Scheme

USN | | | | | | | | | | |

15MT63

Sixth Semester B.E. Degree Examination, June/July 2018
Power Electronics

Time: 3 hrs. Max. Marks: 80

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. **(08 Marks)**

b. With necessary waveforms, explain the switching characteristics of power MOSFET. **(08 Marks)**

OR

2 a. Write the symbol and control characteristics of the following devices:
i) IGBT ii) SCR iii) GTO. **(06 Marks)**

b. Compare MOSFET and IGBT. **(06 Marks)**

c. What are the different types of power electronic converters? **(04 Marks)**

Module-2

3 a. Explain the two transistor model of SCR and derive the expression

$$I_A = \frac{\alpha_2 I_G + I_{CBO_1} + I_{CBO_2}}{1-(\alpha_1+\alpha_2)}.$$ **(08 Marks)**

b. A thyristor circuit is shown in Fig.Q.3(b), the SCR has a latching current of 50mA, and is fired by a pulse of length 50μsec. Show that without resistance R, the thyristor will fail to remain 0_N, when the firing pulse ends. And then find the maximum value of R to ensure firing. **(08 Marks)**

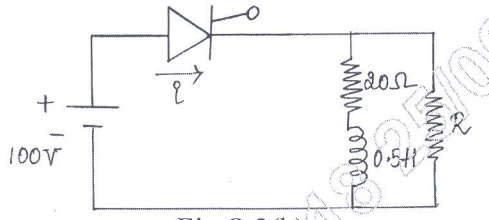

Fig.Q.3(b)

OR

4 a. Define commutation. Compare natural and forced commutation. **(08 Marks)**

b. In the parallel capacitor turn off-circuit shown in Fig.Q.4(b), main SCR T_1 is to be reversed biased for atleast 40μs for proper commutation and holding current of auxiliary SCR T_2 is 2mA. Find R and C. **(08 Marks)**

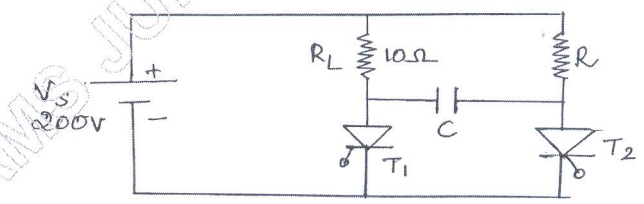

Fig.Q.4(b)

Module-3

5 a. With neat circuit diagram and waveforms, explain operation of single phase AC voltage controller using ON-OFF control. Derive an expression for RMS value of output voltage. **(08 Marks)**

b. A single phase half wave AC voltage controller is shown in Fig.Q.5(b) feeds power to a resistive load of 6Ω from 230V, 50Hz source. The firing angle of SCR is $\alpha = \pi/2$. Calculate:
i) RMS value of output voltage.
ii) Input power factor.
iii) Average input current.
iv) Average output voltage. **(08 Marks)**

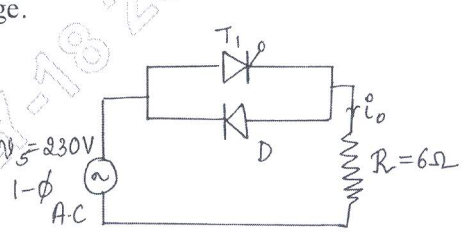

Fig.Q.5(b)

OR

6 a. Explain the operation of single phase semi converter with circuit and waveforms. Derive an expression for average value of output voltage (Assume R-L load). **(08 Marks)**

b. What are the advantages of circulating current-mode dual converter? **(04 Marks)**

c. Mention the applications of AC voltage controller. **(04 Marks)**

Module-4

7 a. Explain the principle of operation of a step-up chopper. **(08 Marks)**

b. A D.C. chopper has an input voltage of 200V and a load resistance of 8Ω. The voltage drop across the thyristor is 2V and chopper frequency is 800Hz. The duty cycle is 0.4. Find:
i) Average output voltage
ii) RMS output voltage
iii) Chopper efficiency. **(08 Marks)**

OR

8 a. Derive an expression for peak-peak ripple in the load current, in case of a step down chopper with R-L load. **(10 Marks)**

b. With neat diagram, explain four quadrant operation of a chopper. **(06 Marks)**

Module-5

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

b. Write a note on performance parameters of a inverter:
i) Harmonic factor of nth harmonic.
ii) Total harmonic distortion (THD).
iii) Distortion factor (DF). **(06 Marks)**

OR

10 a. Compare voltage source inverter and current source inverter. **(06 Marks)**

b. With neat circuit diagram, explain the operation of a three phase transistorized inverter in 180° conduction mode with star connected R-load. **(10 Marks)**

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