B.Tech 6th Semester examination (compartmental), 2022

Course Title – Power Electronics

Course Code – IE602

Full marks -100

Pass Marks -30

Time- 3 hours

1. (a) What are the different types of power diodes? How the reverse recovery time is significant in classification of power diodes? 2+3=5

(b) Draw the forward biased safe operating area and reverse biased safe operating area of a power BJT. 4

(c) Give a comparison of power BJT and power MOSFET. 5

(d) Explain the working of an IGBT. 6

2. (a) Draw the I-V characteristics of an SCR and define the terms- holding current, latching current and forward break over voltage. 5

(b) Using two transistor analogy explain the turn off process of a GTO. 10

(c) What is MCT? How an MCT can be turned on and off? 5

3 (a) What is a phase controlled rectifier? Explain the working of a half wave phase controlled rectifier with RL-load. 10

(b) A single phase 230V, 1KW heater is connected across 1-phase, 230V, 50Hz power supply through an SCR. For firing angle delays of 45° and 90°, calculate the power absorbed in the heating element. 4

(c) A dc battery is charged through a resistor R as shown in fig.1. Derive an expression for the average value of charging current in terms of V_m, E, R etc. on the assumption that the SCR is fired continuously. For an AC source voltage of 230V, 50Hz find the value of average charging current for R=8Ω and E=150V. 2+4=6

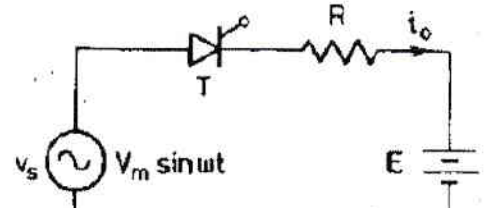

Fig. 1

4. (a) What is a chopper? Explain the control strategies of a chopper. 8

(b) For a type A chopper dc source voltage is 230V, load resistance is 10Ω. Voltage drop across the chopper is 2V when it is on. For a duty cycle of 0.4 calculate -

(i) average and rms values of output voltage

(ii) chopper efficiency 6

(c) A step up chopper has input voltage of 220V and output voltage of 660V. If the non-conducting time of thyristor chopper is 100μS, compute the pulse width of the output voltage. In case pulse width is halved for constant frequency operation, find the new output voltage. 6

5. (a) What is an inverter? Give the steady state analysis of a voltage source single phase bridge inverter and draw its output waveforms for R, RL, RLC – over damped and RLC- Under damped load. 2+6+4=12

(b) Explain the working of a modified McMurray half bridge inverter. 8

6. (a)What is a cycloconverter? Explain the working of single phase to single phase step up cycloconverter. 10

(b) What is SMPS? Explain any one configuration of SMPS. 10

7. (a) What is UPS? Explain various types of UPS. 10

(b) Write short notes on (any two) - 5x2=10

(i) SIT

(ii) SCR protection circuits

(iii) DC motor control