CBCS SCHEME

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

15EE53

Fifth Semester B.E. Degree Examination, July/August 2022
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. Explain the reverse recovery characteristics of diode. **(06 Marks)**

b. Explain freewheeling diode with switched RL load. **(06 Marks)**

c. Write a note on peripheral effects of power converters. **(04 Marks)**

OR

2 a. Explain any three types of power electronic circuits. **(08 Marks)**

b.

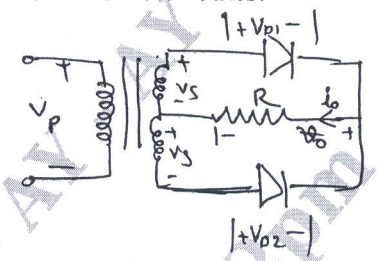

Fig.Q.2(b)

For the rectifier shown in Fig.Q.2(b) V_m is 100V, and resistance 20Ω, find V_{dc}, I_{dc}, P_{ac} and efficiency form factor. **(08 Marks)**

Module-2

3 a. With the sketch, explain working of P-channel depletion type MOS-FET. **(06 Marks)**

b. Explain anti saturation base drive control. **(06 Marks)**

c. How optocoupler can be used for isolation of gate and base drive? **(04 Marks)**

OR

4 a. Explain switching characteristics of MOS-FET. **(08 Marks)**

b.

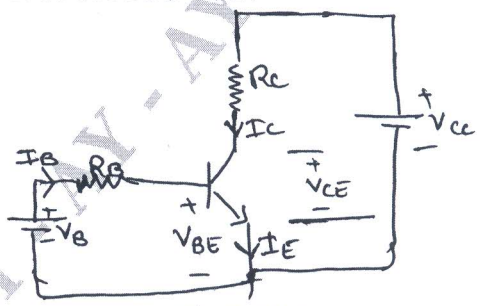

Fig.Q.4(b)

The bipolar transistor as shown in Fig.Q.4(b) is specified to have β_F in the range of 8 to 40. The load resistance is R_C = 11Ω. The DC supply voltage V_{CC} = 200V. The i/p voltage to the base circuit is 10V. If $V_{CE(sat)}$ = 1V and $V_{BE(sat)}$ = 1.5V. Find the value of R_B that results in saturation with an ODF of 5, β_f power loss in transistor. **(08 Marks)**

Module-3

5 a. With neat sketch explain the static V-I characteristics of SCR. What are the significance of latching current, holding current and breakover voltage? **(08 Marks)**

b. Mention and explain various methods of turn on used for thyristors. **(08 Marks)**

OR

6 a. With the help of two transistor model of SCR, derive the expression for anode current. **(08 Marks)**

b. Ten thyristor are used in a string to withstand a DC voltage of $V_S = 15kV$. The maximum leakage current and recovery charge differences of thyristors are 10mA and 150μC respectively. Each thyristor has a voltage sharing resistance $R = 56K\Omega$ and capacitance of $C_1 = .5\mu F$. Determine: i) Maximum study state voltage sharing $V_{DS(max)}$ ii) The study state voltage derating factor iii) Maximum transient voltage sharing $V_{DT(max)}$ iv) The transient voltage derating factor. **(08 Marks)**

Module-4

7 a. With a neat sketch, explain the operation of single phase dual converter. **(08 Marks)**

b. Explain single phase full wave controller with resistive load and derive RMS value of output voltage. **(08 Marks)**

OR

8 a. Single phase fullwave controller has a resistive load of $R = 10\Omega$ and the i/p voltage $V_S < 120V$ (rms), 60Hz. The delay angle of thyristor, T_1 and T_2 are equal, $\alpha_1 = \alpha_2 = \alpha = \pi/2$. Determine RMS output voltage, Input power factor, average current of thyristors I_A, and RMS current of thyristors. **(08 Marks)**

b. With a neat sketch and waveform explain the operation of three phase full wave controller. **(08 Marks)**

Module-5

9 a. With the help of circuit diagram and waveform explain the operation of step-up chopper. **(08 Marks)**

b. Input to the step-up chopper is 200V. The output required is 600V, if the conducting time of thyristor is 200μS, find:

i) Chopping frequency

ii) Pulse width is halved for constant frequency of operation find new (V_o) output voltage. **(08 Marks)**

OR

10 a. Explain the operation of single phase bridge inverter. **(08 Marks)**

b. A single phase full bridge inverter has a resistive load of $R = 10\Omega$ and DC input voltage $V_s = 220V$ calculate:

i) rms output voltage of its fundamental frequency.

ii) The average rms and peak current of each transistor switch. **(08 Marks)**

* * * * *