Full Marks – 70.   Time – 3 Hrs.

FIRST HALF
Answer question no. 6 and two from the rest

1. Draw v-i characteristic of SCR and explain it. Draw two transistor equivalent circuit of Thyristor and explain how on state is achieved. Classify the thyristor with respect to turn-off.   5+6+4

2. What are the different methods of triggering? How undesired triggering can be eliminated? How thyristors can be protected against di/dt and dv/dt triggering?
                                                                                    5+4+6

3. The bipolar transistor in fig– 1 is specified to have β_F in the range of 10 to 40. The load resistance is $R_c = 11\Omega$. The dc supply voltage is $V_{cc} = 200$ V and the input to the base circuit is $V_B = 10$ V. If $V_{CE(sat)} = 1.0$ V and $V_{BE(sat)} = 1.5$ V, find (a) the value of R_B that results in saturation with an ODF(Over Drive Factor) of 5 (b) β_{forced}, and (c) the power loss P_T in the transistor. Deduce any formula you use.
                                                                                    15
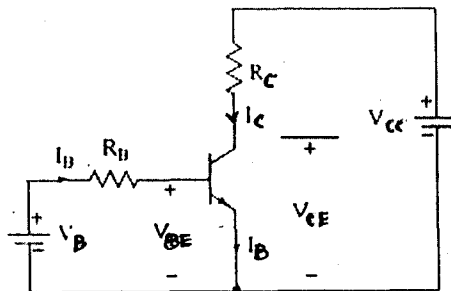

Fig- 1.

4. Draw the schematic construction of a vertical MOSFET. Draw its parasitic model and explain its operation.   7+8

5. Discuss UJT firing circuit with the help of a circuit diagram and its characteristics. An UJT oscillator circuit having following parameters: $V_s = 30$V, $\eta = 0.51$, $I_p = 10\mu A$, $V_v = 3.5$V, $I_v = 10$mA, $R_{b1} = 100$ ohm, $R_{b2} = 654$ ohm, $R = 46.7\ \Omega$, $C = 0.5\mu F$, width of pulse is $t_g = 50$mS, assume $V_d = 0.5$V(may be neglected if necessary). Find the operating frequency. How triggering circuit can be isolated from power circuit?
                                                                                    10+5

6. Name the Power semiconductor device having   5x1

   i) Highest switching speed;
   ii) Highest voltage / current rating;
   iii) Easy control drive features;
   iv) Gate turn-off capability with regenerative features;
   v). Easy control drive and power handling capability;

Second Half

Answer question no. 4 and any two from rest

1. a) Describe with the help of necessary voltage waveforms and circuit diagrams, the operation of a three phase voltage source inverter with 180^0 conduction mode, delivering power to a star connected balanced resistive load.
   b) A single phase full bridge inverter has an inductive load. Draw the current and voltage waveform of the load.   10+4

2. a) Why is a three phase bridge controlled rectifier called a six pulse converter? Explain briefly with circuit diagram and output voltage waveforms, the operation of a six pulse converter.
   b) A three phase six pulse converter is operated from a three phase star connected 400V, 50 Hz supply with resistive load. It is required to obtain an average output voltage equal to 50% of the maximum possible output voltage of the rectifier.
   Find out at the condition (i) the firing angle (ii) the output average voltage
   (iii) Explain how the above mentioned converter can act as rectifier and inverter.
                    8+4+2

3. a) Explain with a neat diagram the operation of Cük converter.
   b) A basic step down chopper, the input voltage is 30V load is 50Ω duty cycle is 50%, Find out (i) the average output voltage and current (ii) average freewheeling diode current.   10+4

4. Write short notes on (any two)   3½ + 3½
   a) Induction heating
   b) SMPS
   c) UPS
   d) High voltage DC transmission
   e) DC Motor Speed Controller