M.TECH. DEGREE EXAMINATION

Model Question Paper - I

First Semester

Branch: Electrical and Electronics Engineering

Specialization: Power Electronics and Power Systems

MEEPP 102 POWER ELECTRONIC CIRCUITS

(2013 admission onwards)

Time: Three Hours   Maximum: 100 Marks

1. (a) Compare the switching characteristics of power MOSFETs and power transistors bringing out the advantages of one over the other.   (15 marks)

   (b) For an SCR, the gate cathode characteristics are given by a straight line passing through the origin with a gradient of 16V/A. the turn-on time is 4μs and the gate current required is 500mA. For the gate-source voltage of 15V, calculate; (i) gate power dissipation; (ii) the resistance to be connected in series with the gate.

                                                                    (10 marks)

OR

2. (a) Explain the Static and dynamic characteristics of IGBT?   (10 marks)

   (b) Discuss the overvoltage, over current, di/di and dv/dt protection of power semiconductor device.

                                                                    (10 marks)
   (c) Compare the power diode with signal diode?   (5 marks)

3. (a).With neat diagram and waveform, explain the operation of a single phase rectifier (uncontrolled) with RL load and capacitive filter. Derive the expression for the performance parameters of the rectifier.   (15 marks)

   (b). Discuss the effect of source inductance on the performance of the rectifier.

                                                                    (10 marks)

OR

4. (a). What are dual converters? Mention their advantages and applications.   (7 marks)

   (b) Explain the inversion mode of operation of converter.   (8 marks)

(c). A 3-phase full converter is fed by a 400V, 3-phase 50Hz supply. The average load current is 100A. Assuming highly inductive load, for a firing angle of 60^0, determine.

      i.   Output voltage and power.
     ii.   Average r.m.s. and peak currents through the SCR.
    iii.   PIV of the SCR.

(10 marks)

5. (a) Explain the basic working principle of a chopper.   (5 marks)

  (b). Describe the voltage commutated chopper with associated voltage and current waveforms as a function of time.   (10 marks)

  (c) What is a multiphase chopper? Explain the operation. List the merits and demerits of multiphase choppers   (10 marks)

OR

6. (a). Explain the working of a 3-phase current source inverter with necessary waveforms.
(10 marks)

  (b). What is the need for controlling the output of an inverter? Discuss briefly and compare the various methods employed for the control of output voltage of inverters.
(10 marks)

  (c) Explain the significance of multi level inverter.
(5 marks)

7. (a) Explain the principle of operation of three phase AC voltage controllers
(10 marks)

  (b) A single phase a.c. voltage controller controls the power input to a load consisting of R = 3Ω and WL = 4Ω. For a supply voltage of 230V, 50Hz, calculate:

     (i)   Control range of firing angle.
    (ii)   Maximum r.m.s. load current.
    (iii)   Maximum power input to the load.
    (iv)   Maximum p.f.
    (v)   Maximum Value of average and r.m.s. thyristor current.

(15 marks)

OR

8. (a) Explain the two stage sequence control of AC voltage controller with relevant waveform.
(10 marks)

  (b). Explain the operation of a 3-phase cycloconverter. Draw the waveforms.
(15 marks)

[4 x 25 = 100 marks]