Paper Code:EE502	Roll No.									

B.Tech.
(SEM V) ODD SEMESTER EXAMINATION2015-16
POWER ELECTRONICS

[Time: 3 hrs.] **[Max. Marks: 100]**

Note- ***Attempt All Questions. All Questions carry equal marks*:-**

1. **Answer any four parts of the following:** **5x4=20**
   a) Explain the different modes of operation of SCR with the relevant characteristics.
   b) Draw two transistor model of a SCR and explain its turn-on mechanism. Why does SCR not turn-on in reverse biased condition?
   c) List specifications of a power electronic switch.
   d) List ac to dc and ac to ac power electronic converters and draw their output.
   e) Explain switching characteristics of a power transistor.
   f) Draw V-I characteristics of a GTO and explain its operation.

2. **Answer any four parts of the following:** **5x4=20**
   a) For type-A chopper, dc source voltage=230 V. load resistance=10 Ω. Take a voltage drop of 2 V across chopper when it is on. For a duty cycle of 0.4, calculate
      i. average and rms values of output voltage
      ii. Chopper efficiency.
   b) On what factors the di/dt rating of thyristor depend? What device techniques are used to improve the di/dt rating?
   c) In a series parallel connection of SCRs the voltage and current rating of a circuit are 3kV & 750A. SCRs with a rating of 800V & 175A are available. The recommended minimum derating factor is 15%. Calculate.
      i. No. of series and parallel units required.
      ii. R and C required for equalization if the maximum forward leakage current of SCR is 10mA and ΔQ=20 μc.
   d) Why does unequal voltage sharing take place among series connected thyristors during steady state and dynamic state? How is equal voltage shaving obtained in both the states?
   e) Draw the circuit diagram and waveforms for resonant pulse commutation. Why the commutation capacitor in a resonant pulse commutation does get overcharged?
   f) What is dc chopper? Explain the principle of operation of a step-up chopper.

3. **Answer any two parts of the following:** **10x2=20**
   a) For a single phase full wave controlled converter system sketch waveforms for load voltage and load currents for:
      i. RL load
      ii. RLE load with free-wheeling diode across RL
   b) Draw circuit diagram of a single phase dual converter and explain its working in continuous current mode of operation. How are the firing angles of both converters decided? Discuss the need of center tapped inductor.
   c) Explain operation of a 3-phase full wave fully controlled converter feeding a highly inductive load making current continuous and draw load voltage waveform for firing angle, $\alpha > 60^{\circ}$. Derive an expression for dc output voltage.

4. Answer any two parts of the following: 10x2=20

a) A single phase full wave ac regulator feeds apure resistive .load. Derive an expression foroutput voltage.

A single phase, 220 V, 1 KW electricroom heater is connected across 220 V acsupply through a TRIAC. For a delay angleof 90° calculate the power dissipated by theheater element.

b) A 230V, 50Hz 1phase HW rectifier is triggered at firing angle 40◦. The load current extinguishes at angle of 210◦ find the
   i. average output voltage
   ii. Average load current for RL=25Ω & L=4mH.

c) Explain working of a single phase bridge type cycloconverter. Draw output voltage Waveformfor resistive load.

5. Answer any two parts of the following: 10x2=20

a) Discuss the principle of working of a single phase series inverter. What are the advantages and disadvantages of series inverter?

b) Discuss with neat circuit diagram the working of three phase bridge inverter for 180° conduction of a thyristor with three phase balanced star connected resistive load. Also state its merits and demerits.

c) Through flourier analysis, explain the harmonic reduction techniques and output voltage control of inverter.