(Set-R_1)

B.Tech-6th
Power Electronics

Full Marks : 70

Time : 3 hours

Answer Q. No. 1 is compulsory and five questions from the rest

The figures in the right-hand margin indicate marks

1. Answer the following questions : 2 × 10

(*a*) What are the protections needed for an SCR ?

(*b*) What is the purpose of using freewheeling diode in a ac-dc controlled converter ?

(*c*) How many SCRs are conducting during overlap period in case of a 1-phase full wave converter ?

(*d*) What will be firing angle of an 230V 1-phase full-controlled converter feeding a resistive load with 100V ?

(*e*) What will be output RMS voltage when an triac is fired with angle "α" ?

(*f*) What is the difference between IGBT and IGCT ?

(*g*) What is the necessity of source inductor in case of a CSI ? What are the drawbacks of CSI ?

(*h*) Draw an R-C triggering scheme. What will be maximum firing angle of this scheme ?

(*i*) What is the advantage of a chopper operating under fixed frequency control ?

(*j*) What is the objective of using UJT in triggering scheme ?

2. (*a*) Draw an cosine-law triggering scheme and explain its working principle. 5

(*b*) Discuss briefly about IGBT with V~I characteristic. 5

3. (*a*) What do you mean by forced commutation ? Discuss briefly about current commutation with its relevant waveforms. 5

(*b*) Derive rms voltage of an triac feeding a resistive load. Which type of firing scheme will be required for triac control ? 5

4. A single-phase 250V, 50 Hz half-controlled bridge converter provides a ripple-free load current of 10A at firing angle of 30 degree.

(*a*) Draw the circuit diagram and its voltage and current waveforms of both load and source side. 4

(*b*) Find the average output voltage, RMS input current, displacement and distortion factor. 6

5. (*a*) Derive the expression of average load current in terms of 'α' and 'μ' for a single-phase fully-controlled converter having source inductance "*Ls*" feeding ripple free load current. 5

(*b*) Explain the operation of a 1-phase series inverter and its limitations and modifications. 5

6. (*a*) Draw an 1-phase cyclo-converter and explain its operation. What modification is needed to improve the fundamental output ? 5

(*b*) Draw circuit diagram of a 1-phase CSI. Explain its operation with load voltage and current waveforms. 5

7. (*a*) Draw an 3-phase bridge inverter feeding balanced load and its phase and line voltage when it is operating under 180 degree mode. 5

(*b*) Explain four-quadrant operation of chopper. 5

8. Write short notes on any two of the following : 5 + 5

(*i*) UJT triggering scheme

(*ii*) Step-up chopper

(*iii*) Series and parallel connection of SCRs.
