B. Tech.

(SEM. VI) EXAMINATION, 2006-07

EE - 604 : POWER ELECTRONICS

Time : 3 Hours] [Total Marks : 100

Note : Answer all questions.

1 Answer any four parts out of the following :

(a) What are the characteristics of an ideal power-switching device? Compare the characteristics of IGBT and MOSFET. 5

(b) Name the different power electronic converters available and list their advantages over conventional modes of conversion and control. 5

(c) Draw the static V-I characteristics of SCR and explain its modes of operation. 5

(d) What are the different methods of firing employed for SCR triggering? Explain UJT firing circuit with relevant waveforms. 5

(e) Define di/dt and dv/dt ratings of SCR. How is SCR protected against these? 5

(f) In a power circuit 4 SCRs are to be connected in series. Permissible difference in blocking voltage is 20 V for a maximum difference in their blocking currents of 10 mA. Difference in recovery charge is 10 micro coulomb. Design suitable equilizer circuit. 5

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2 Answer any **two** parts out of the following:

(a) Discuss the working of single-phase full wave ac-dc converter taking into account the effect of source inductance. Draw the output voltage waveform for firing angle 30 degrees.

(b) A three phase full converter is fed by 400 Volts, three phase, 50Hz supply. The average load current is 150 A and load is highly inductive. For a firing angle of 60 degrees find output power, average, rms and peak current through thyristors and peak inverse voltage.

(c) What are dual convertors? Explain operation of a three phase dual converter using circulating current mode of operation. How are firing angles of two converters controlled?

3 Answer any **four** parts out of the following:

(5 marks each)

(a) Describe the operation of single phase full wave ac regulator feeding a resistive load. Derive expression for output voltage.

(b) A single phase voltage controller has input voltage of 230 volts, 50 Hz and R=15 ohms. For 6 cycles on and 4 cycles off, determine rms output voltage and input power factor.

(c) Describe the operation of solid state AC and DC transfer switches.

(d) Draw the circuit and waveforms of single phase to single phase step up cycloconverter for output frequency = Four times input frequency. Assume continuous conduction.

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(e) Derive the expression for the fundamental rms value of per-phase output voltage of low frequency for an m-pulse cycloconverter.

(f) Explain the working of three phase bi-directional delta connected AC voltage controller.

4 Answer any two parts out of the (10 marks each) following:

(a) The resonant pulse commutation circuit has C=30 micro Farad and L=4 micro Henry. The initial capacitor voltage is $V_c=200$ Volts. Determine $T_{OFF}$ if load current is 250 Ampere.

(b) Describe the working of step up chopper and derive expression for output voltage.

(c) A 220 volts, 25A, 1000 rpm separately excited DC motor has armature resistance 1.5 ohms and is controlled by a chopper of 600 Hz and source voltage 230 Volts. Calculate duty ratio for rated.

5 Answer any two parts out of the (10 marks each) following:

(a) A 3-phase bridge VSI feeds three-phase star connected resistive load. Obtain the output phase and line voltage if two SCRs conduct at a time.

(b) Differentiate between the working of voltage source and current source inverters. Explain the working of a single phase series inverter.

(c) Describe forward and reverse speed control of three phase ac voltage controller with relevant circuit diagram. Discuss its merits and demerits.