B.E. Electrical (Electronics & Power) Engineering (Model Curriculum) Semester-VI
TE206 - Power Electronics

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Notes : 1. All questions carry equal marks.
         2. Due credit will be given to neatness and adequate dimensions.
         3. Assume suitable data wherever necessary.
         4. Illustrate your answers wherever necessary with the help of neat sketches.
         5. Answer **any five** questions as per internal given choice.
         6. Use of non-programmable calculator is permitted.

1. a) Describe the different modes of operation of a thyristor with the help of its static V-I   **8**
            characteristics.

        b) Draw the gate characteristics of an SCR and explain it.   **8**

                                            OR

2. a) Draw the V-I characteristics of a Triac and explain its working principle.   **8**

        b) What is IGBT? What are the advantages of IGBT over power BJT and power MOSFET?   **8**

3. a) Explain with the help of neat power-diagram and associated waveforms, the operation of a   **8**
            single-phase half-wave controlled converters with
            i)   Resistive load   ii)   Inductive load.

        b) Explain the operation of three-phase fully-controlled bridge converter with resistive load.   **8**
            Describe in detail the following modes of operation with associated waveforms
            i)   Discontinuous conduction mode.   ii)   Continuous conduction mode.

                                            OR

4. a) Describe the working of single-phase fully-controlled bridge converter in the following   **8**
            two-modes:
            a)   Rectifying mode   b)   Inversion mode
            Also, sketch the following waveforms for a = 45° and a = 120°
            i)   Load voltage waveform   ii)   Load current waveform
            iii) Thyristor current and voltage waveforms
            iv) Supply voltage and current waveforms.

        b) A three-phase, fully-controlled bridge converter is supplying a d.c. load of 400V, 60A   **8**
            from a three phase, 50 Hz, 660V (line) supply. If the thyristors have a voltage drop of
            1.2V when conducting then, neglecting overlap, compute
            i)   The firing angle of thyristor   ii)   RMS current in thyristors
            iii) The mean power loss is thyristors
            iv) If the a.c. supply has an inductance per phase of 3.6 mH, what will be the new value
                 of firing angle required to meet the load requirements?

5.	a)	Explain 3ϕ bridge inverter operation for 180º mode of operation with relevant phase voltage waveform.	**8**
	b)	Draw a modified series inverter circuit. Explain qualitatively how you can have output frequency higher than series resonance frequency.	**8**

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6.	a)	Compare 180º and 120º conduction mode of 3 phase bridge inverter.	**8**
	b)	Explain the operation of single-phase bridge inverter with the help of load, voltage and load current waveforms.	**8**

7.	a)	Draw the schematics of step-down chopper. Explain its working and derive an expression for output voltage in terms of duty-cycle for a step-down chopper.	**8**
	b)	A chopper circuit is operating on TRC principle at a frequency of 1 kHz on a 220 V d.c. supply. If the load voltage is 180V, calculate the conducting and blocking period of thyristor in each cycle.	**8**

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8.	a)	With the help of a circuit diagram, explain the working of class D chopper.	**8**
	b)	A step down dc chopper has a resistive load of R = 15 ohm and input voltage Edc = 200V. When the chopper remains ON, its voltage drop is 2.5 V. The chopper frequency is 1 kHz. If the duty cycle is 50%, determine : i) Average output voltage ii) RMS output voltage iii) Chopper efficiency iv) Effective input resistance of chopper.	**8**

9.	a)	Draw and explain the necessity of static and dynamic equalizing circuit for series connected SCRs? Derive relations used for determining the values of shunt resistor R and capacitor C in this circuit.	**8**
	b)	What are the problems associated with firing of parallel connected SCRs? Draw and explain circuit for firing of parallel connected SCRs.	**8**

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10.	a)	What do you mean by Snubber circuit? Draw and explain the function of each component.	**8**
	b)	What are the different methods of triggering SCRs in series? Draw and explain sequential firing circuit for triggering of series connected SCRs.	**8**

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