Roll No .....

EX - 504

B.E. V Semester

Examination, June 2015

Power Electronics Devices and Circuits

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii) All parts of each questions are to be attempted at one place.

iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.

iv) Except numericals, Derivation, Design and Drawing etc.

Unit-I

1. a) What is the necessity for connecting power semiconductor devices in series? What are the precautions to be taken in such condition?

   b) Discuss the over voltage and dv/dt protection of power semiconductor devices.

   c) Sketch the turn-off characteristics of an SCR and there from explain the turn-off mechanism.

   d) What are the various methods of turn-on of SCRs, explain?

   OR

   Following are the specifications of a thyristor operating from a supply of peak voltage 500V. Repetitive peak current rating of SCR, $I_P = 250A$. Also,

Unit-V

5. a) What is a cycloconverter? Discuss its principle.

   b) Draw the circuit diagram voltage and current waveform of single phase full wave voltage controller with resistive load.

   c) List the advantage and disadvantages of Back and Boost regulators.

   d) The single phase full-wave controller has a resistive load of 1.5 Ω with input voltage 120V at 50Hz. If the desired output power is 7.5 kW. Determine

      i) Firing angles of thyristors

      ii) rms output voltage

      iii) Input power factor

   OR

   Discuss the operation of Cuk converter with the help of a circuit diagram and voltage and current waveforms.

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$$\left(\frac{di}{dt}\right)_{Max} = \frac{60A}{\mu s}; \left(\frac{dVa}{dt}\right)_{Max} = \frac{200V}{\mu s}$$

Take a suitable factor of safety for these specifications mentioned above. Design a suitable a suitable snubber circuit if the minimum load resistance is 20Ω. Take r = 0.65.

Unit-II

2. a) Explain the effect of freewheeling diode.

   b) The half wave circuit is supplied at 120V line to neutral. Determine the average load voltage for firing angle 0°, assuming the load current to be continuous and level with a constant 2.5V drop on each thyristor.

   c) Discuss the effect of source inductance on the performance of a single phase fully controlled converter, indicating clearly the conduction of various thyristor during one cycle.

   d) Explain the operation of a three phase fully-controlled bridge converter with inductive load. Draw the voltage and current wave forms for $\alpha = 70°$. List the firing sequence of SCRs.

   OR

   Three phase half-wave rectifier consists of a resistance and a very large inductance. The inductance is so large that the output current I_d can be assumed to be continuous and ripple free. For $\alpha = 60°$

   i) Determine average value of output voltage if phase voltage, $V_P = 120V$.

   ii) Draw the waveforms of output voltage and output current.

Unit-III

3. a) Explain the principle of operation of an inverter.

   b) Compare between voltage source and current source inverter.

   c) Why voltage control is needed in inverter circuits? State the various methods of voltage control in inverter circuits.

   d) Draw and explain the operation of 1-ϕ McMurray - Bedford full bridge inverter circuit. Also draw the related voltage and current waveform.

   OR

   Draw and explain the operation of three-phase series inverter circuit. State the limitation of this inverter.

Unit-IV

4. a) Draw the schematics of step-up and step-down choppers.

   b) Give the classification of chopper commutation.

   c) With the help of voltage and current waveforms, explain the working of first quadrant chopper.

   d) Describe a Morgan chopper with associated voltage and current waveforms. Enumerate the demerits of Morgan chopper compared to Jones chopper.

   OR

   A step-up chopper has input voltage of 220V and output voltage of 660V. If the non-conducting time of thyristor is 100μ sec. Compute the pulse width of output voltage. If the pulse width is halved for a constant frequency operation, find the new output voltage.