B. TECH
(SEM VI) THEORY EXAMINATION, 2018-19
POWER ELECTRONICS

Time: 3 Hours   *Total Marks: 70*

Note: 1. Attempt all Sections. If you require any missing data, choose suitably.

SECTION A

1.   **Attempt *all* questions in brief.**   2 x 7 = 14

   a.   Enumerate the similarities and differences between Latching Current and Holding current in SCR.
   b.   Draw transfer characteristic of Power MOSFET.
   c.   Give expression for average voltage of single phase semi converters.
   d.   What are the advantage and disadvantage of cycloconvertor?
   e.   List various methods of commutation. Explain in brief external pulse commutation.
   f.   Write the applications of various power electronics devices.
   g.   What are the advantages of single phase bridge converter over single phase mid-point converter?

SECTION B

2.   **Attempt any *three* of the following:**   7 x 3 = 21

   a.   Draw & Explain output characteristics of IGBT.
   b.   Explain the working of Buck boost converter with neat diagram & derive a output voltage Vo= - Vs*k / (1-k) , k- duty factor
   c.   What do you understand by dual converters? With the aid of neat diagram, explain the working of three phase dual converter.
   d.   Describe the operation of multistage sequence control of ac voltage controller with neat diagram, also With help of neat circuit diagram; explain the operation of single phase sinusoidal AC voltage controller.
   e.   Differentiate between the working of voltage source and current source inverter. Explain the working of single phase series inverter.

SECTION C

3.   **Attempt any *one* part of the following:**   7 x 1 = 7

   (a) Describe with neat diagram the working of IGBT with its transfer characteristics.
   (b) What are differences in gating Characteristics of TRIAC and GTO?

4.   **Attempt any *one* part of the following:**   7 x 1 = 7

   (a) Find the number of thyristors each with a rating of 500 V and 75 A required for each branch of series and parallel combination for a circuit for a total voltage and current rating of 7.5kV and 1 kA. Also compare the series and parallel string efficiency. Assume derating factor of 14 %.

(b) Draw & Explain the circuit for external pulse commutation and prove that $V_c = 2V$, Where V_c is capacitor voltage and V external d.c. supply.

5. Attempt any *one* part of the following: 7 x 1 = 7

(a) A single phase half controlled converter feeds Power to RLE load with R = 5 ohms, L= 10 mH, E = 20 V the source voltage is 230 V, for continuous condition, find the average value of load current for firing angle of 45 degree in case one of four SCRs gets open circuited, find the new value of average current assuming continuous output current.

(b) Justify the statement "why a single phase rectifier with highly inductive load is called a converter" with mathematical derivation of the expression for average output voltage.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) A single phase fully controlled bridge converter supplies a load drawing constant and ripple free load current, if the triggering angle is 30^0, what value of input power factor will be?

(b) Explain the operation of single phase to single phase step down cyclo converter with voltage and current wave forms.

7. Attempt any *one* part of the following: 7 x 1 = 7

(a) A single phase voltage source inverter is controlled in a single pulse-width modulated mode with a pulse width of 150^0 in each half cycle. Total harmonic distortion is defined as

$$THD = \sqrt{(V^2rms - V_1^2)}/V_1 * 100$$

Where V_1 is the rms value of the fundamental component of output voltage. Calculate THD of Output ac voltage waveform.

(b) What is the need for controlling the voltage at the output terminal of an inverter? Describe Briefly and compare the various methods employed for the control of output voltage of Inverter.