B.Tech III Year I Semester (R09) Regular & Supplementary Examinations December 2014
POWER ELECTRONICS
(Common to EEE and E.Con.E)

Time: 3 hours

Max Marks: 70

Answer any FIVE questions
All questions carry equal marks
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1 (a) Give the construction details of an SCR with the help of schematic diagram and the circuit symbol.
   (b) Explain the importance of gate signal in SCR.

2 (a) What are the basic advantages and disadvantages of R and RC triggering circuit?
   b) (Two thyristors having a difference of 4 mA in latching current are connected in series with the circuit. Voltages across the devices are 420 V and 300 V. Calculate the required equalizing resistance and also design a suitable RC circuit for thyristor if the permissible difference in blocking voltage is 8 V and difference in recovery charge is 2 μC.

3 (a) Explain the operation of 1-phase half controlled bridge converter with R-load and associated waveforms.
   (b) Derive the expression for average load voltage for $\alpha = 30$ deg.

4 (a) Draw and explain the output voltage waveforms of 1-phase fully controlled converter at $\alpha = 45$ deg.
   (b) A 1-phase full bridge converter is used to regulate dc output voltage. The rms value of ac input is 230 V; 50 Hz and firing angle α is 45deg. So that the load current is 5 A. Calculate: (i) The dc output voltage. (ii) Active and reactive power input with and without freewheeling diode.

5 (a) Explain the operation of a three phase half-wave rectifier with R-load with suitable waveforms.
   (b) Derive expressions for average voltage and current of 3-phase half-wave rectifier.

6 (a) Explain the basic principle of operation of cycloconverter with a neat circuit diagram.
   (b) A three pulse cycloconverter feeds a single phase load of 190 V, 45 A at a power factor of 0.7 lagging. Determine: (i) The required supply voltage. (ii) Thyristors rating. (iii) Power factor of the supply current. Neglect device and supply impedance volt-drops.

7 (a) Show that the expression for per unit ripple in the load current is given by $\dfrac{\left(1-e^{-\alpha T/T_a}\right)\left(1-e^{-(1-\alpha)T/T_a}\right)}{\left(1-e^{-T/T_a}\right)}$

   where T = Chopping period, α = duty cycle and $T_a = L/R$
   (b) For type A chopper, source voltage V_s = 220 V, chopping frequency = 500 Hz; T_{on} = 800 μs and R = 1 Ω; L = 1 mH; and E = 72 V. sketch the time variations of (i) Gate signal i_g. (ii) Load current i_0. (iii) Load voltage v_0.

8 (a) What are the different PWM techniques employed for inverters?
   (b) Explain the operation of single pulse modulation of inverter with neat diagram

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