DILIP KUMAR

(Following Paper ID and Roll No. to be filled in your answer book)

Paper ID   Roll No. [| | | | | | | | |]

M.Tech
FIRST SEMESTER EXAMINATION, 2009-2010
POWER CONVERTERS - I

Time: 3hrs.   *Max. Marks 100*

Note: Attempt all questions. All questions carry equal marks.

1. Solve any two parts of the followings: (10x2)

   (a) How does a GTO differ from a conventional thyristor ? Discuss its static V-I Characteristics. Under what conditions, it may operate as a low gain transistor?

   (b) Describe the working of a Triac and discuss with a circuit diagram its turning on phenomena.

   (c) Explain the causes of over voltage and over current in a converter circuit and also describe with neat circuit diagram the over voltage & over current protection scheme for the converter.

2. Solve any two parts of the followings: (10x2)

   (a) Discuss single-phase full converter with R-L-E_b load. Explain how this converter operates as line-commutated inverter.

   (b) A single-phase half controlled bridge converter feeds a load comprising of a resistance of 10 ohm and a large inductance to provide a constant and ripple free current. Calculate the input output performance parameters of the converter circuit if firing angle delay is 45° and input ac voltage is 120 V, 50 Hz. Neglect the device and other voltage drops.

   (c) Discuss with neat circuit diagram and relevant waveform three-phase semi converter under discontinuous mode of operation. Also derive the expression for the output voltage of the above.

3. Solve any two parts of the followings: (10x2)

(a) Discuss with neat circuit diagram and relevant waveform three-phase dual converter circuit under continuous conduction mode of operation.

(b) A three phase full converter is supplying a constant and ripple free current of 8 A with delay angle fixed at 45° from a three phase ac supply of 400 V, 50 Hz. Express the input current in Fourier series and calculate (i) the harmonic factor of input current, (ii) the displacement factor and, (iii) input power factor.

(c) Explain the requirement of power factor control of the converter. Also describe PWM control technique to improve the power factor of the converter.

4. Solve any two parts of the followings: (10x2)

(a) Discuss single-phase ac regulator for R-L load using on-off control technique. Also explain the drawbacks of this method.

(b) A single phase ac regulator with resistance has the following data: Supply mains: 230 V, 50 Hz, R= 4 Ω. Calculate:
 (i) the firing angle at which greatest forward or reverse voltage is applied to either of the thyristors and the magnitude of these voltages.
 (ii) the rms value of fifth harmonic current and its phase for $\alpha = 45°$.

(c) Describe the working of two-stage sequence control of voltage controller for both R and RL load. What is the advantage of this controller over single-phase full wave controller?

5. Solve any two parts of the followings: (10x2)

(a) Describe with neat circuit diagram and relevant waveform three-phase ac regulator for firing angle delay of 60°.

(b) Discuss single-phase step up cycloconverter with relevant waveform for output frequency $f_o = 6f_i$, where f_i is input frequency.

(c) Discuss why output voltage waveform of a cycloconverter contains harmonics? Also explain how these harmonics can be eliminated?