ME(E&TRX) Sem II (R) 27/05/09
Power E&TRX. 11-3

Con. 3243–09. **BB–5817**

(4 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**. From remaining **six** questions **solve** any **four** questions.
(2) **Figures** to the **right** indicate **full** marks.
(3) Draw neat sketches / waveforms wherever **necessary**.
(4) Assume **suitable** additional data if **necessary**.

1. Answer as directed :–

(a) Explain $\frac{dv}{dt}$ and $\frac{di}{dt}$ ratings of SCR, give typical magnitudes of these and related protection circuits. **4**

(b) Explain the reason for high frequency modulation of gate pulse as used in some applications. **4**

(c) Explain why power factor in semiconverter is better than that of full converter when both are operating in rectifier mode with same power output. **4**

(d) Can semiconverter be operated in inverter mode ? Give reasons for your answer. **4**

(e) Draw torque-speed characteristics of d.c. separately excited shunt motor and explain the two regions of operation. **4**

2. (a) Explain the effect of source inductance on performance of single phase full converter operating in (i) rectifier mode and in (ii) inverter mode. Draw relevant waveforms and give expressions of input / output voltage in both cases. **10**

(b) A single phase full converter is supplied with 250 V, 50 Hz supply. The load current is continuous and ripple free. If the source inductance is 0.5 mH and load current is 75 Amps, determine angle of overlap (μ) for firing delay angle (α) = $\pi/4$. **10**

3. (a) Explain how full converter can be used to drive d.c. separately excited motor in motoring mode and how the converter can be used to electrically brake the motor using generator mode using relevant waveforms. Give range of firing delay angles in both the cases. **10**

(b) A 3 phase full converter is used to drive separately excited d.c. motor of rating 250 V, 1000 RPM, 50 Amps, R_a = 0.2 ohm. If input to converter is 440 V. 50 Hz 3 phase supply determine (i) firing delay angle for motoring mode at 800 RPM with half of full load torque. (ii) firing delay angle for braking of motor at 700 RPM with full load torque. **10**

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4. (a) Explain the working of chopper driven d.c. motor control in the following cases using relevant circuit diagrams :– 10

   (i) Motoring mode
   (ii) Regenerative brake mode
   (iii) Rheostatic brake mode.

   (b) A 220 V, 1000 RPM, 100 Amps d.c. separately excited shuntmotor is working in brake mode using Rheostatic Chopper circuit. Determine suitable value of R_B and calculate duty ratio for operation at 700 RPM with half the full load torque. Assume R_a = 0.1 ohm for the motor. 10

5. (a) Explain working of multiple pulse sinusoidal PWM inverter using suitable waveforms. How $\frac{V}{f}$ technique be used with this circuit to control a.c. induction motor ? Give advantages of this circuit when compared to single pulse inverters. 10

   (b) List and give details such as speed-torque characteristics for various techniques of speed control of a.c. wound rotor induction motors. Which of these techniques are preferred for large power motors ? Give reasons. 10

6. (a) Explain principle of operation, specifications and drive circuit for switched reluctance stepper motor. Give two applications of the motor. 10

   (b) Using appropriate waveforms explain working of cycloconverter with output of 10 Hz for input frequency of 50 Hz. 5

   (c) Discuss effect of harmonics on operation of a.c. motors. 5

7. Write short notes (any **three**) :– 20

   (a) Protection circuits for overload in motor controllers
   (b) Safe operation area rating (SOAR) in power BJT
   (c) Current source inverters – working, advantages and applications
   (d) Vector control of induction motors.