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BIEL-019

B. TECH.-VIEP-ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

June, 2019

BIEL-019 : POWER ELECTRONICS

Time : 3 Hours *Maximum Marks : 70*

Note : *Attempt any* ***seven*** *questions. All questions carry equal marks. Use of scientific calculator is allowed. Missing data, if any, may be suitably assumed.*

1. (a) Enumerate the voltage commutation techniques of SCR. Draw suitable voltage and current waveforms. 5

   (b) Draw the switching characteristics of SCR during turn on and turn off conditions. 5

2. A single-phase full converter, connected to 230V, 50 Hz source is feeding load R = 10 Ω in series with large inductance that makes the load current ripple free. For a firing angle of 45°, calculate input and output parameters of this converter. 10

3. (a) Derive an expression for circulating current for a 3-phase dual converter in terms of supply voltage. Sketch the relevant voltage and current waveforms. 8

   (b) Describe how a freewheeling diode improves power factor in a converter system. 2

4. (a) Explain the working of a single phase full wave midpoint phase controlled converter with RL load. 5

   (b) SCRs with rating of 1000 V and 200A are available to be used in string to handle 6 kV and 1 kA. Calculate the number of series and parallel units required in case derating factor is 0.1. 5

5. (a) Describe the operation of a step up chopper. How can it be used for regenerative braking of DC motors. 5

   (b) A current commutated chopper is fed from a dc source of 230 V. Its commutating components are L = 20 μH and C = 50 μF. If load current of 200 A is assumed constant during commutation process; then compute : 5

      (i) Turn off time of main thyristor and auxillary thyristor.

      (ii) Total commutation interval.

6. Discuss the working of 120° node conduction scheme of a three phase bridge inverter with its relevant waveforms. Also find the expression for phase and line voltages. 10

7. (a) In a single phase series inverter, the operating frequency is 50 kHz and the thyristor turn off time $t_q = 10\,\mu s$. Circuit parameters are R = 3Ω, L = 60 μH, C = 7.5 μF and V_S = 220 V dc. Determine : 5

   (i) The circuit turn off time.

   (ii) Maximum possible operating frequency, with factor of safety = 1.5.

   (b) Discuss the closed loop control of DC drives. 5

8. (a) The speed of 15 hp, 220 V, 1000 rpm DC series motor is controlled using a single phase, half controlled bridge converter. The combined armature and field resistance is 0.2 Ω. Assume continuous ripple free motor current and speed of 1000 rpm and $k = 0.03$ Nm/amp^2. Determine : 5

   (i) Motor current

   (ii) Motor torque for fringe angle α = 30°, AC voltage is 250 V.

(b) What are ac drives ? Give the merits and demerits of ac drive with respect to dc drives ? 5

9. (a) Explain the working of static Scherbius. Drive for obtaining speed below as well as above synchronous speed. 5

(b) Describe static rotor resistance control method for speed control of 3-phase induction motor. 5

10. Write short notes on any ***two*** of the following : 2×5

(a) Single phase PWM inverter

(b) RC Firing circuit by thyristors

(c) Power MOSFET

(d) Working of IGBT