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BIEL-019

B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

December, 2015

BIEL-019 : POWER ELECTRONICS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any* ***seven*** *questions. Draw neat waveforms and circuit diagrams. Use of scientific calculator is allowed. Missing data, if any, may be suitably assumed.*

1. Describe the working of a single-phase full converter in the inverter mode with RLE load. Illustrate your answer with waveforms for source voltage, E, load voltage and current, source current, current through and voltage across SCR. Assume continuous conduction. Also find the circuit turn-off time. Should the average output voltage be more than E during inverter operation ? Discuss. *10*

2. A single phase semi-converter feeds power to RLE load. For discontinuous load current, draw the source voltage, output voltage, load current, source current and freewheeling diode current waveforms as a function of time, when the

(a) extinction angle $\beta > \pi$, and

(b) extinction angle $\beta < \pi$ with $V_n \sin \beta < E$. *10*

3. A step-down chopper, fed from 220 V d.c., is connected to RL load with R = 10 Ω and L = 150 mH. Chopper frequency is 1250 Hz and duty cycle is 0·5. Calculate the

(a) minimum and maximum values of load current,

(b) maximum value of ripple current,

(c) average and rms values of load current, and

(d) rms value of chopper current. *10*

4. Show that the performance of a single-phase full converter with the help of typical current and voltage waveforms as effected by source inductance is given by the relation

$$\cos(\alpha + \mu) = \cos \alpha - \omega L_s I_0 / V_m$$

where the symbols have their usual meaning. *10*

5. The turn-off process in a GTO can be described with its two-transistor model. Explain this in detail. *10*

6. Discuss the principle of working of a three-phase bridge inverter with an appropriate circuit diagram. Draw and explain the phase and line voltage waveforms on the assumption that each thyristor conducts for 120°. *10*

7. A series motor used for a rapid transit system is fed through a d.c. chopper. The series motor has total circuit resistance of 2 Ω and inductance of 2 mH. What external inductance should be inserted in series with the armature circuit in order to limit the per unit ripple in armature current to 10% for a duty cycle of 0·5 ? The chopping frequency is 1 kHz. *10*

8. Describe how the speed of a separately excited d.c. motor is controlled through the use of two 3-phase full converters. Discuss how two-quadrant drive can be obtained from this scheme. *10*

9. Describe the stator-current control method for the speed control of a 3-phase induction motor. *10*

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

(a) Commutation Techniques

(b) Power MOSFET

(c) Synchronous Drives
