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## P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

**Fourth Semester, B.E. - Electronics and Communication Engineering**

**Semester End Examination; June/July - 2015**

**Industrial Electronics**

*Time: 3 hrs*

*Max. Marks: 100*

**Note:** i) Answer **FIVE** full questions, selecting **ONE** full question from each **Unit**.

ii) Assume suitable missing data if any.

### UNIT - I

1. a. Explain different types of power converters with suitable waveforms. Also list the applications of power electronics. 8
- b. Explain the peripheral effects of power converters. 6
- c. With the help of a neat waveforms. Explain the control characters of power BJT, MOSFET and IGBT. 6
2. a. With the help of a neat diagram explain the cross section and equivalent circuit for IGBTs. 8
- b. Explain  $dv/dt$  and  $di/dt$ . What are its limitations? 6
- c. Explain the need for Isolation of gate and base drives. 6

### UNIT - II

3. a. Explain the operation of the thyristor with the help of two transistor analogy. 8
- b. Explain turn-on and turn off dynamic characteristics of the thyristor. 8
- c. Ten thyristors are used in a string to withstand a dc voltage of  $V_s = 15$  kV. The maximum leakage current and Recovery charge differences of thyristors are 10 mA and 150  $\mu$ C respectively. Each thyristor has a voltage sharing resistance of  $R = 56$  k $\Omega$ ,  $C_1 = 0.5$   $\mu$ F. Compute; 4
  - i)  $V_{DS(max)}$  ii) Derating factor (DRF)
  - iii) Transient voltage derating factor iv) Maximum transient voltage sharing  $V_{DT(max)}$
4. a. Explain the different ways of turning on the thyristors. 4
- b. Explain  $dv/dt$  and  $di/dt$  protection in thyristors. 8
- c. With the help of neat waveforms and circuit diagram, explain UJT firing circuit. 8

### UNIT - III

5. a. With the help of neat diagram and waveforms explain the principle of ON-OFF AC Voltage controllers. 8
- b. Explain the working of single phase-Bidirectional controllers with Inductive load. 10

- c. List the applications of AC voltage controllers. 2
6. a. Explain the principle of operation of single phase semi converter. 8
- b. The single phase dual converter is operated from 120, 60 Hz supply and the load resistance  $R = 10 \Omega$ . The circulatory inductance  $L_C = 40 \text{ mH}$  delay angles  $\alpha_1$  and  $\alpha_2$  are  $60^\circ$  and  $120^\circ$ . Calculate peak circulatory current and peak current of converter I. 4
- c. Explain the working of single phase dual converter. What are the advantages of circulating current in dual converters? 8

#### UNIT - IV

7. a. With the help of a neat diagram explain the principle of step-down operation in choppers. 6
- b. Explain the operation of step down chopper for inductive loads with the help of wave forms. 8
- c. Explain two quadrant and four quadrant choppers. 6
8. a. Explain the principle of operation of step-up chopper. 8
- b. Explain the performance parameters of choppers. 4
- c. A choppers is feeding an  $R_L$  load with  $V_S = 220 \text{ V}$ ,  $R = 5\Omega$ ,  $L = 7.5 \text{ mH}$ ,  $f = 1 \text{ kHz}$ ,  $K = 0.5$ , and  $E = 0 \text{ V}$ . Calculate;
- i) Minimum instantaneous load current  $I_1$  8
- (ii) Peak Instantaneous load current  $I_2$
- (iii) Maximum peak to peak Ripple current
- (iv) The average value of load current  $I_a$ .

#### UNIT - V

9. a. Explain the principle of operation of single phase half-bridge inverter. 8
- b. Explain the following parameters :
- (i) Harmonic factor of nth harmonic 6
- (ii) Total Harmonic Distortion
- (iii) Distortion factor DF
- c. Write a note on current source Inverter. 6
- 10 a. List the specifications of standard power supplies used in Industries. 4
- b. Explain the four common configurations of switch mode power supplies. 16

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