Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 31400

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Fifth Semester

Electrical and Electronics Engineering

EE 2301/EE 51/10133 EE 504/10144 EE 504 — POWER ELECTRONICS

(Common to Instrumentation and Control Engineering)

(Regulation 2008/2010)

(Common to PTEE 2301 Power Electronics for B.E. (Part-Time) Fourth Semester – Electrical and Electronics Engineering – Regulation 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List the various forced commutation techniques used to turn off SCR.

2. What is a snubber circuit?

3. Mention the disadvantages of dual converter with circulating current mode of operation.

4. A single phase full converter feeds power to RLE load with R = 6Ω, and E = 60 V. The load inductance value is very large so as to maintain the load current continuous and ripple free. The ac source voltage is 230 V and 50 Hz. Find the average value of the output voltage for a firing angle delay of 50°.

5. What do you mean by time ratio control?

6. What is a DC chopper?

7. What is the advantage of 120° mode of inverter operation over 180° mode?

8. List the various advantage of using PWM control to inverters?

9. What is a matrix converter?

10. Enumerate some of the industrial applications of a cycloconverter.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Draw and explain the switching characteristics of SCR. (8)

(ii) Discuss the working of a complementary commutation circuit of SCR with a neat circuit diagram and waveforms. (8)

Or

(b) Describe the basic structure of IGBT and explain its working. Give its equivalent circuit and explain the turn ON and turn OFF processes. (16)

12. (a) Describe the working of a single phase full converter in the rectifier mode with RL load. Discuss how one pair of SCRs is commutated by an incoming pair of SCRs. Illustrate your answer with the waveforms of source voltage, load voltage and source current. Assume continuous conduction. Also derive the expressions for average and rms output voltage. (16)

Or

(b) (i) A 3 – phase full converter charges a battery from a three – phase supply of 230 V, 50 Hz. The battery emf is 200 V and its internal resistance is 0.5 Ω. On account of inductance connected in series with the battery, charging current is constant at 20 A. Compute the firing angle delay and supply power factor. (8)

(ii) Describe briefly the working of Dual converter with a neat circuit diagram. (8)

13. (a) (i) A dc battery is charged from a constant dc source of 220 V through a chopper. The dc battery is to be charged from its internal emf of 90 V to 122 V. The battery has internal resistance of 1Ω. For a constant charging current of 10 A, compute the range of duty cycle. (8)

(ii) Explain with a neat circuit diagram one of the configurations of SMPS. (8)

Or

(b) (i) Explain the principle of working of a step up chopper with neat circuit diagram and necessary waveforms. Derive the expression for its average output voltage. (10)

(ii) Write short note on resonant switching. (6)

14. (a) Discuss the principle of working of a three phase bridge inverter with an appropriate circuit diagram. Draw the output phase and line voltage waveforms on the assumption that each thyristor conducts for 180° and resistive load is star connected. The sequence of firing of various SCR should also be indicated. (16)

Or

(b) Write short note on the following :

(i) Sinusoidal pulse width modulation as applied to inverters

(ii) Current source inverters. (8 + 8)

15. (a) Describe the basic principle of working of $1\phi - 1\phi$ step down cycloconverter for a bridge type converter. Assume both discontinuous and continuous conduction and draw the load current and load voltage waveforms for both the cases. Mark the conduction of various thyristors. (16)

Or

(b) Write short note on the following :

(i) Integral cycle control

(ii) Multistage sequence control

(iii) Step up cycloconverter

(iv) Matrix converter. (4 + 4 + 4 + 4)
