B.Tech III Year I Semester (R13) Supplementary Examinations June 2017

POWER ELECTRONICS

(Electrical & Electronics Engineering)

Time: 3 hours Max. Marks: 70

PART - A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) What is holding current in SCR?
(b) Define latching current.
(c) What causes poor input power factor in phase controlled DC drives?
(d) What are the advantages of three phase drives over single phase drives?
(e) List the various control strategies for varying duty cycle of the chopper.
(f) Write the advantages in operation of choppers at high frequency.
(g) What is PWM?
(h) List the voltage control techniques for inverters.
(i) Write the types of cycloconverters.
(j) Write the applications of cycloconverters.

PART - B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

2 (a) Explain the different modes of operation of thyristor with the help of its V-I characteristics.

(b) Define the following terms with reference to SCR: (i) Peak inverse voltage. (ii) Voltage safety factor.

OR

3 (a) Draw the symbol of a thyristor and list the merits and demerits of thyristors.

(b) Draw the switching characteristics of power MOSFETs. Define turn – ON delay time, rise time, turn – ON time, turn – OFF delay time, fall time and turn – OFF time.

UNIT - II

4 (a) What are lines commutated converters? Explain briefly.

(b) What is half wave converter? Derive the expression for an average DC output voltage of a single-phase half wave converter with R load.

OR

5 A single-phase fully controlled bridge rectifier supplies R load. By assuming the constant output current, find the following performance factors if the supply voltage is 230 V and if the firing angle is $\pi/3$ and $R = 5\Omega$. (i) Average output voltage. (ii) Supply RMS current. (iii) Supply fundamental current. (iv) Fundamental power factor. (v) Input power factor. (vi) Voltage ripple factor.

UNIT - III

6 (a) Discuss the time ratio control in a dc chopper.

(b) A chopper circuit is operating on time ratio control (TRC) principle at a frequency of 1 kHz on 220 V d.c. supply. If the load voltage is 180 V, calculate the conducting and blocking period of thyristor in each cycle.

OR

7 (a) Define chopper. What are the types of chopper? What are the applications of chopper?

(b) A chopper operating on TRC constant frequency principle is feeding a dc series motor having an armature resistance of 0.06 ohm and a field resistance of 0.03 ohm. The average circuit current is 15 A and the chopper frequency is 500 Hz. The back emf of the motor is 100 V. Find the periods of conduction and blocking. The chopper input is 200 V.

Contd. in page 2

Code: 13A02503

R13

UNIT - IV

8 (a) What do you mean by voltage source and current source inverters? Explain the basic operation of a single phase voltage source inverter.

(b) Explain sinusoidal pulse modulation used for PWM inverters and also write its important features.

OR

9 What is pulse-width modulation? List the various PWM techniques. How do these differ from each other?

UNIT - V

10 (a) Explain the operation of a single phase AC voltage controller with R load and derive all the necessary equations.

(b) Explain the applications of cycloconverter.

OR

11 (a) Define the term power factor. Derive its expression for single phase voltage controller feeding a resistive load.

(b) For a single phase midpoint cycloconverter, explain the operation of the circuit when fed to R-load with the help of circuit diagram and relevant output waveforms for $\alpha = 30°$ and $f_0 = f_s/4$.

*****