Question Paper Code : 90206

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fifth Semester

Electrical and Electronics Engineering

EE8552 – POWER ELECTRONICS

(Common to : Mechatronics Engineering)

(Regulations 2017)

Time : Three Hours   Maximum : 100 Marks

Codes/Tables/Charts to be permitted, if any may be indicated

Answer ALL questions

PART – A   (10×2=20 Marks)

1. List the different methods to turn on the SCR.

2. Define : threshold voltage of power MOSFET.

3. Write the relation between firing angle and extinction angle in single-phase fully controlled rectifier when operating with RL load.

4. Mention the output ripple frequency of 2 pulse, 3 phase and 6 pulse converter.

5. Name the two types of control strategies available for dc choppers.

6. Define duty cycle in dc chopper.

7. Compare free wheeling diode with feedback diode.

8. Why the THD has to be mitigated ?

9. Give the demerits of cyclo-converter.

10. What is matrix converter ?

PART – B   (5×13=65 Marks)

11. a) i) Discuss the basic structure and operation of power IGBT.   (8)

    ii) Explain the typical protection arrangement for a SCR.   (5)

(OR)

  b) Describe the principles of different commutation methods of SCR.

12. a) i) Explain the effect of source inductance in the performance of the single-phase fully controlled rectifier. **(10)**

    ii) Write a short notes on light dimmer. **(3)**

    (OR)

    b) Explain the working of three-phase fully controlled converter. Also show that this is suitable for two quadrant operation. **(13)**

13. a) i) Explain the principle of working of the buck-boost chopper with suitable waveforms and mode diagrams. **(8)**

    ii) Explain how the resonant converters differ from conventional hard switched converters. Also provide the different categories of resonant dc-dc converters. **(5)**

    (OR)

    b) Explain the waveforms of type D chopper. Derive the expression for current Ripple when it feeds RL load.

14. a) Explain the principle of working of three phase VSI in 120° conduction mode with a star connected load. **(13)**

    (OR)

    b) From the fundamental concept, explain the space vector modulation scheme suitable for three phase VSI. **(13)**

15. a) i) A single phase cycloconverter has input voltage of 230 V, 50 Hz and load of R = 10 Ω. Output frequency is one-third of input frequency. For a firing angle delay of 30°, calculate :
       a) the rms value of output voltage
       b) the rms current value of each thyristor
       c) the input PF. **(8)**

    ii) Explain in detail about the ON/OFF control applicable to single phase ac voltage. **(5)**

    (OR)

    b) i) Explain the two stage sequence control of single phase ac voltage controller. **(7)**

    ii) A single phase AC voltage full wave controller is employed for controlling the power flow from 230 V, 50 Hz source into a load circuit consisting of R = 3 Ω and X_L = 4 Ω. Calculate :
       a) the control range of firing angle
       b) the maximum value of rms load current
       c) the maximum power and power factor. **(6)**

PART – C (1×15=15 Marks)

16. a) Provide the detailed working of single phase capacitor commutated CSI with R load. Through a systematic analysis obtain the output current and voltage equations. Also mention the design considerations. (15)

(OR)

b) i) The buck regulator has an input range of $V_S = 12$ V. The regulated average output voltage is $V_a = 5$ V at $R = 500\ \Omega$ and the peak to peak output ripple voltage is 20 mV. The switching frequency is 25 KHz if the peak to peak ripple current of inductor is limited to 0.8 A, determine : (9)

   a) The duty cycle, K

   b) The filter inductance, L

   c) The filter capacitance, C and

   d) The critical value of L and C

ii) A single phase AC voltage controller has a resistive load of $R = 10\ \Omega$ and input voltage $V_s = 120$ V, 60 Hz the delay angle of thyristor T_1 is $\alpha = \dfrac{\pi}{2}$. Determine :

   a) the rms value of output voltage V_0

   b) the input PF and

   c) the average input current. (6)