Code No: 115AF

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November/December – 2016
POWER ELECTRONICS
(Electrical and Electronics Engineering)

Time: 3 hours   Max. Marks: 75

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART – A

(25 Marks)

1.a)   Define Latching current.   [2]
 b)   What is the importance of line commutation?   [3]
 c)   What are the advantages of Free wheeling diode?   [2]
 d)   What is meant by overlapping period in phase controlled converters?   [3]
 e)   Write few applications of choppers.   [2]
 f)   What is meant by Time Ratio Control?   [3]
 g)   What assumptions are considered for the operation of inverters?   [2]
 h)   Classify inverters according to connections.   [3]
 i)   Draw the basic structure of TRIAC and its circuit symbol.   [2]
 j)   Define AC voltage controller.   [3]

PART – B

(50 Marks)

2.a)   Give the constructional details of SCR with the help of schematic diagram and circuit symbol.
 b)   Explain in detail the two transistor analogy of SCR.   [5+5]

OR

3.a)   Describe the different modes of operation of a thyristor with the help of its V-I characteristics.
 b)   Two thyristors having a difference of 4mA in latching current are connected in series in the circuit. Voltages across the devices are 450V and 300V. Calculate the required equalizing resistance and capacitance, if the permissible difference in blocking voltage is 10V and the difference in the recovery charge is $5\mu C$.   [5+5]

4.a)   Explain the operation of single phase fully controlled converter with RL load. Derive the output voltage and current expressions for firing angle of 45 degrees.
 b)   A single phase fully rectifier is used to supply power to load having impedance 200 ohms and 150 mH, from 230V, 50Hz, ac supply at a firing angle of 90 degrees. Calculate
   i) Average values of output voltage and current
   ii) RMS values of output voltage and current.   [5+5]

OR

5.   Explain the operation of three phase Bridge type Full Converter with RL – load with neat waveforms.   [10]

6.a) What is time ratio control in dc choppers? Explain the use of TRC for controlling the output voltage in choppers.

b) A step-up chopper has input voltage of 220V and output voltage of 660V. If the conducting time of thyristor-chopper is 100μs, compute the pulse width of output voltage. In case the output-voltage pulse width is halved for constant frequency operation, find the average value of new output voltage? [5+5]

OR

7.a) Describe the Morgan chopper with associated voltage and current waveforms.

b) Enumerate the merits of Morgan chopper compared to Jones chopper. [5+5]

8. Discuss the following:
   a) Single pulse Modulation
   b) SPWM Technique. [5+5]

OR

9. Explain in detail about 180^0 Conduction Mode of 3 – Ø Voltage Source Inverters. [10]

10.a) Explain the various modes of operation of TRIAC with the help of equivalent circuits and relevant waveforms.

b) A single phase half wave AC voltage controller has a resistive load of R = 40 ohms and the input voltage is Vs = 230V, 50Hz. The Delay angle of thyristor is 50 degrees. Determine
   i) The rms value of output voltage V_0,
   ii) The input power factor,
   iii) The average input current. [5+5]

OR

11. Describe the operating principle of single-phase to single-phase step-up cycloconverter with the help of mid-point and bridge type configuration. Illustrate your answer with appropriate circuit and waveforms. [10]

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