R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November - 2015
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) What are the applications of power MOSFET? [2]
 b) What are the factors that affect the turn off time of SCRs? [3]
 c) What is phase control technique? [2]
 d) What are the applications of dual converters? [3]
 e) What is an AC chopper? [2]
 f) What are the different kinds of power losses in Choppers? [3]
 g) What is an AC voltage controller? [2]
 h) What are the applications of Cyclo converters? [3]
 i) What is sinusoidal PWM technique? [2]
 j) What are the applications of parallel inverter? [3]

PART - B (50 Marks)

2.a) Explain in detail about the series connection of SCRs.
 b) Following are the specifications of a Thyristor operating from a peak supply of 400V:
   Repetitive peak current $I_P = 200A, \left(\dfrac{di}{dt}\right)_{max} = 50\dfrac{A}{\mu s}, \left(\dfrac{dv_a}{dt}\right)_{max} = 180\dfrac{V}{\mu s}$.
   Design a Snubber circuit if the minimum load resistance is 15Ω. Take damping ratio as 0.7 and the factor of safety as 2 [5+5]

OR

3.a) What are the main specifications and ratings of SCR to be considered while designing? Explain.
 b) An UJT circuit has the following parameters:
   $\eta = 0.67, V_D = 0.6V, I_v = mA, V_v = 1V, I_p = 10\,\mu A, V_{BB} = 20V$
   Find the values of V_{EE} so as to turn on UJT if R_E is (i) 1 kΩ (ii) 1500 Ω [5+5]

4.a) Derive the expression for the average load voltage of single phase half controlled converter with RLE load.
 b) A three phase half wave SCR converter delivers constant load current of 20A over the firing angle range of 0^0 to 60^0. At these two firing angles, compute the power delivered to load for an ac input voltage of 300V from a delta star transformer. [5+5]

OR

5.a) Derive the expression for the RMS load voltage of six pulse converter with R load.
 b) In a single phase midpoint converter turns ratio from primary to each secondary is 2. The source voltage is 230V, 50 Hz. For a resistive load of 5Ω, calculate the maximum value of average output voltage and load current and the corresponding firing and conduction angles [5+5]

6.a) Explain in detail about the time ratio control.
   b) A step down chopper is fed from 200V DC and its duty cycle is 0.6. Calculate the RMS value of output voltages for fundamental and third harmonic components.   [5+5]

OR

7.a) Derive the expression for the output voltage of step up chopper.
   b) A chopper fed from a 200V DC source, is working at a frequency of 50 Hz and is connected to an RL load of R = 4Ω and L = 30 mH. Determine the value of duty cycle at which the minimum load current will be (i) 5 A   (ii) 10 A   [5+5]

8.a) Explain the operation of a single phase mid-point step up cyclo converter with the help of circuit diagram and waveforms
   b) A single phase voltage controller with resistive load has the following data: supply mains: 230V, 50 Hz, R = 5Ω. Calculate the firing angle at which the greatest forward or reverse voltage is applied to either of the thyristors and the magnitude of these voltages   [5+5]

OR

9.a) Explain the operation of a single phase bridge type step down cyclo converter with the help of circuit diagram and waveforms
   b) A single phase voltage controller with RL load has the following data:
      Supply mains: 230V, 50 Hz, Z = (3+j4) Ω. Calculate the control range of firing angles and the maximum value of RMS load current   [5+5]

10.a) Draw the circuit diagram of a single phase half bridge inverter and explain its operation.
   b) A three phase bridge inverter delivers power to a resistive load from a 400V DC source. For a star connected load of 8Ω per phase, determine RMS value of load current and RMS value of thyristor current for 120^0 conduction mode of operation.   [5+5]

OR

11.a) Explain the 180^0 conduction mode of operation of three phase inverters with necessary circuit diagram and waveforms.
   b) A single phase bridge inverter is fed from a 200 DC. In the output voltage wave, only fundamental component of voltage is considered. Determine the RMS current ratings of an SCR and a diode of the bridge for a resistive load of R = 5Ω.   [5+5]

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