

Total No. of Questions : 8]

SEAT No. :

P-7599

[Total No. of Pages : 3

[6180]-116

T.E. (E & TC)

POWER DEVICES AND CIRCUITS

(2019 Pattern) (Semester - II) (304194)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 and Q8.
- 2) Neat diagrams and Waveforms must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of nonprogrammable calculator is allowed.
- 5) Assume suitable data if necessary.

Q1) a) Explain working of single phase half bridge inverter (using MOSFET/ IGBT) for R-L load with input & output waveforms. [7]

b) Single phase full bridge inverter is operated from 50V dc supply, it has a resistive load of  $R=5\Omega$ . Find. [6]

- i) RMS o/p voltages at third & fifth harmonic ( $V_{O3}$  &  $V_{O5}$ )
- ii) Distortion factor (DF) of 3<sup>rd</sup> harmonic component
- iii) Total Harmonic Distortion (THD)

c) Distinguish between freewheeling diode with feedback diode. [4]

OR

Q2) a) What is mean by harmonics in inverters? Explain effects of harmonics. [5]

b) Draw a three phase inverter for balanced star R load? Explain its operation of 180° mode with gate signals & output waveforms. [12]

Q3) a) Explain working of step down chopper for R load and derive an expression for its average o/p voltage? [6]

b) Explain with block schematic working of SMPS. [6]

c) A step down chopper is operated from dc supply voltage of 230V. It has resistive load with  $R=10\Omega$ . If duty cycle is 40%, calculate : [6]

- i) Average & rms o/p voltages
- ii) Average & rms o/p currents
- iii) Chopper efficiency

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OR

- Q4)** a) A step up chopper is operated from 220V dc supply and it provides 550V output. If chopping frequency is 1KHz, calculate ON & Off times of chopper. [4]
- b) What are various types of choppers? Explain operation of two quadrant chopper with circuit diagram. [8]
- c) Draw circuit diagram of step up chopper and distinguish between step up & step down choppers. [6]

- Q5)** a) What are different over voltage protection techniques in power electronics? Explain any one in detail. [7]
- b) Why isolation is required in power electronic circuits? Explain with neat diagram working of isolation transformer. [6]
- c) For a thyristor, Maximum junction temperature is 150°C. The thermal resistances are  $\theta_{JC} = 0.16^\circ\text{C/W}$ ,  $\theta_{CS} = 0.08^\circ\text{C/W}$ . for heat sink temperature of 60°C, calculate total average power loss in thyristor - sink combination. [4]
- If heat sink temperature is reduced to 50°C, find new total average power loss in thyristor - sink combination. [4]

OR

- Q6)** a) What is resonant converter? What are its various types? Explain any one resonant converter with circuit & waveforms. [8]
- b) What is EMI? Explain various sources & minimizing techniques of EMI. [5]
- c) Explain the role of heat sink in power electronic circuits with its thermal equivalent circuit. [4]

- Q7)** a) Explain with circuit diagram single phase full wave AC voltage controller for R-load. Also draw following waveforms? [7]
- Input voltage
  - Gate signals for power devices
  - Output voltage
  - Output current

- b) What is UPS? Explain operation of Off line UPS with block schematic.[6]
- c) Explain with suitable circuit diagram working of a LED driver. [5]

OR

- Q8) a) Explain various performance parameters of batteries used in battery operated power systems. [6]
- b) Explain with diagram architecture of EVs battery charger. [6]
- c) Explain working of electronic ballast with block schematic. [6]

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