

Printed Pages : 4

TEE - 603

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2061

Roll No.

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B. Tech.

(SEM. VI) EXAMINATION, 2008-09

POWER ELECTRONICS

Time : 3 Hours]

[Total Marks : 100

Note : Attempt all questions.

- 1 Attempt any **four** parts of the following : $5 \times 4 = 20$
- (a) Describe dynamic characteristic of power diode.
 - (b) Explain the two transistor analogy of thyristor.
 - (c) Explain operation of GTO thyristor.
 - (d) Discuss the problems of parallel connection of power BJTs and their solutions.
 - (e) What are differences in the gating characteristics of BJTs and MOSFETs?
 - (f) Compare IGBT and power MOSFET switches with reference to converter applications.
- 2 Attempt any **four** parts of the following : $5 \times 4 = 20$
- (a) On what factors the di/dt rating of thyristor depend? What device techniques are used to improve the di/dt rating?
 - (b) Explain the problems associated with the series operation of thyristor.



- (c) Draw the circuit diagram and waveforms for resonant pulse commutation. Why does the commutation capacitor in a resonant pulse commutation gets overcharged?
- (d) What is dc chopper? Explain the principle of operation of a step-up chopper.
- (e) Draw the circuit diagram of class D chopper and explain its operation in brief.
- (f) For type-A chopper, dc source voltage = 230 V, load resistance = 10 Ω . Take a voltage drop of 2V across chopper when it is on. For a duty cycle of 0.4, calculate
- average and rms values of output voltage
 - chopper efficiency.

3 Attempt any **two** parts of the following : **10×2=20**

- (a) A single phase half wave rectifier shown in **Fig. 1** has a purely resistive load R. Determine :
- the efficiency
 - the form factor
 - the ripple factor
 - the transformer utilization factor and
 - the peak inverse voltage of diode.

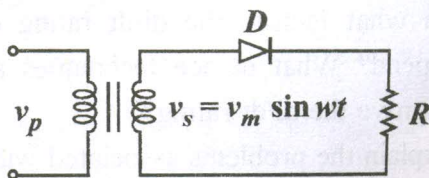


Fig. 1



- (b) A single-phase fully controlled bridge converter is connected to RLE load. The source voltage is 230 V, 50 Hz. The average current of 10A is continuous over the working range. For $R = 0.4 \Omega$, compute
- firing angle delay for $E = 120 \text{ V}$,
 - firing angle delay for $E = -120 \text{ V}$.
- Indicate which source is delivering power to load in parts (i) and (ii),
- In case output current is assumed constant, find the input pf for parts (i) and (ii).
- (c) Draw the circuit diagram and output voltage waveforms of three-phase fully controlled bridge converter with highly inductive load for $\alpha = 90^\circ$. Derive an expression for average output voltage.

4 Attempt any **two** parts of the following : $10 \times 2 = 20$

- What are the advantages and disadvantages of on-off control? What are the advantages and disadvantages of phase-angle control? Derive the expression of rms output voltage for single-phase full wave (bidirectional) ac voltage controller with resistive load?
- A single-phase full wave (bidirectional) ac voltage controller has a resistive load $R = 10 \Omega$ and the rms input voltage, $V_s = 230 \text{ V}$, 50 Hz. The thyristor switch is on for $n = 25$ cycles and is off for $m = 75$ cycles. Determine :



- (i) the rms output voltage V_o
 - (ii) the input power factor and
 - (iii) the average and rms currents of thyristors.
- (c) Explain the working principle of single-phase cycloconverter by drawing circuit diagram and necessary waveforms. What are the advantages and disadvantages of cycloconverter?

5 Attempt any **four** parts of the following : 5×4=20

- (a) Explain the operating principle of single-phase half-bridge inverter with suitable diagram and waveforms.
- (b) Compare voltage source and current source inverters.
- (c) Discuss single-phase-width modulation for voltage control of single-phase inverters.
- (d) Discuss advantages of sinusoidal pulse-width modulation over multiple-pulse-width modulation. Draw the waveforms for sinusoidal pulse-width modulation.
- (e) Draw the circuit diagram and waveforms for three-phase voltage source inverter for 180° mode of condition.
- (f) What is dead zone of a resonant inverter? What are the advantages and disadvantages of resonant inverters with bidirectional switches ?

