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

PAPER ID : 2061 Roll No. | | | | | | | | | | |

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 : **5×4=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 : **5×4=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 of 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

(i) average and rms values of output voltage

(ii) 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 :

(i) the efficiency

(ii) the form factor

(iii) the ripple factor

(iv) the transformer utilization factor and

(v) the peak inverse voltage of diode.

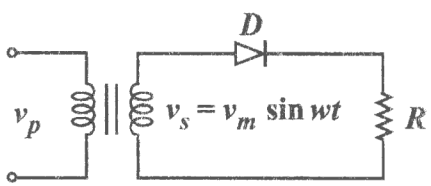

Fig. 1

(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

(i) firing angle delay for E = 120 V,

(ii) firing angle delay for E = –120 V.

Indicate which source is delivering power to load in parts (i) and (ii),

(iii) 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 : **10×2=20**

(a) 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?

(b) A single-phase full wave (bidirectional) ac voltage controller has a resistive load $R = 10\,\Omega$ and the rms input voltage, $V_s = 230$ V, 50 Hz. The thyristor switch is on for n = 25 cycles and is off for m = 75 cycles. Determine :

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(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 ?
