Printed Pages : 4 **TEE – 603**

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

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

B. Tech.

(SEM. VI) EXAMINATION, 2007-08

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 the structure and dynamic characteristic of a power diode.

(b) On what factors does the di/dt rating of thyristor depend? What device techniques are used to improve the di/dt rating ?

(c) Explain the problems associated with series operation of thyristors and how are they overcome.

(d) In low power applications, explain your preference between GTO and bipolar transistors giving supporting arguments.

(e) Enumerate the advantages of MCT over ordinary SCR.

(f) Explain second breakdown in power BJTs.

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

(a) Draw and explain scrubber circuit for dv/dt protection thyristor.

(b) Explain the dynamic equilizing circuit for series-connected SCRs.

(c) What are the differences between voltage and current commutation? Explain with suitable circuit diagrams.

(d) Explain the principle of operation of dc chopper. Discuss different classifications of dc chopper.

(e) Draw the circuit diagram and explain the operation of class C chopper.

(f) A step-up chopper has input voltage of 220V and output voltage of 660V. If the non-conducting time of thyristor-chopper is 100 μ s, compute the pulse width of output voltage.

In case pulse width is halved for constant frequency operation, find the new output voltage.

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

(a) A single-phase full wave rectifier with centre-tapped transformer has a purely resistive load R. *Determine:*

(i) efficiency

(ii) ripple factor

(iii) transformer utilization factor and

(iv) peak inverse voltage (PIV) of diode.

(b) A single-phase full converter feeds power to RLE load with R = 6 Ω, L = 6mH and E = 60 V. The source voltage is 230 V. For continuous condition, find the average value of

load current for firing angle 45°. In case one of the four SCRs gets open circuited, find the new value of average current assuming continuous output current.

(c) Draw the circuit diagram and output voltage waveforms of three phase semiconverter with highly inductive load for $\alpha = 90^{\circ}$. Derive an expression for average output voltage.

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

(a) Explain the principle of on-off control and phase-angle control. For a single-phase ac voltage controller feeding a resistive load, show that power factor is given by the expression :

$$\left[\frac{1}{\pi}\left\{(\pi-\alpha)+\frac{1}{2}\sin 2\alpha\right\}\right]^{1/2}$$

(b) A single phase half wave (Unidirectional) ac voltage controller has a resistive load of $R=10\,\Omega$ and the input voltage is $V_S=230$ V, 50 Hz. The delay angle of thyristor is $\alpha = \pi/2$.

Determine :

(i) the rms value of output voltage V_o and

(ii) the input power factor.

(c) What is cycloconverter? Enumerate some of its industrial applications. Draw the circuit diagram and waveforms for a single-phase cycloconverter and explain its working principle.

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

(a) Explain the operating principle of single-phase full-bridge inverter with suitable diagram and waveforms.

(b) Discuss the merits and demerits of voltage source and current source inverters.

(c) Discuss the merits and demerits of PWM control of Voltage Source inverters.

(d) Discuss the advantages of multiple-pulse width modulation scheme over single pulse width modulation for voltage control of single-phase inverters. Draw the waveforms for multiple-pulse-width modulation scheme.

(e) Draw the circuit diagram and waveforms for three-phase voltage source inverter for 120^{o} mode of conduction.

(f) What is the necessary condition for series resonant oscillation? Discuss the advntages of using bidirectional switches in resonant inverters.
