Total number of printed pages--4

53 (IE 602) PWEL

2019

POWER ELECTRONICS

Paper : IE 602

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* How IGBT differs from MOSFET and BJT ? Give a comparison. 6

   (b) Draw the equivalent circuit of IGBT, SCR and MCT using BJT and MOSFET. 6

   (c) Draw the I-V characteristics of SCR and explain the terms — holding current, latching current, forward blocking region and forward breakover voltage. 8

Contd.

2. *(a)* How an SCR can be protected against high di/dt and high dv/dt? 6

(b) Draw the structure of a GTO and explain the turn on and turn off methods of GTO. 10

(c) Draw the structure of TRIAC. Also draw its I-V characteristics. 4

3. *(a)* Explain the working of a half wave controlled rectifier with R-load. State what changes to its output will occur if the load is *(i)* RL *(ii)* RLC. 12

(b) Obtain the expression for power factor for a bridge controlled rectifier using R-load. 8

4. *(a)* What is a chopper? What are the control strategies of a chopper? Explain each control strategy. 8

(b) Draw the circuit diagram and derive the input-output voltage relation of—

(i) Step down chopper

(ii) Step up chopper

(iii) Step up/Step down chopper. 12

5. *(a)* A step up chopper has input voltage of $220V$ and output voltage of $660V$. If the conducting time of thyristor-chopper is $100\mu s$, compute the pulse width of output voltage. In case output voltage pulse width is halved for constant frequency operation, find the average value of new output voltage. 6

(b) A type-A chopper has input dc voltage of $200V$ and a load of $R = 10\Omega$ in series with $L = 80mH$. If load current varies linearly between $12A$ and $16A$, find the time ratio T_{on}/T_{off} for this chopper. 4

(c) What is an inverter? Explain the working of a single phase bridge inverter. 10

6. *(a)* Give the steady state analysis of a single phase bridge inverter. Draw the output waveforms for R-load RL-load and RLC-load. 12

(b) What is an SMPS? Explain *any one* configuration of SMPS. 8

7. *(a)* Explain the working of a short break and a no break UPS. 10

(b) What is a cycloconverter? Explain the working of *any one* type of cycloconverter. 10