Total No. of Questions : 12] **SEAT No. :**

P4591 **[Total No. of Pages : 3**

[4957] - 165
S.E. (E&TC Engineering)
POWER DEVICES AND MACHINES
(2008 Pattern)

Time : 3 Hours] ***[Max. Marks :100***

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
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.***

SECTION - I

Q1) a) Compare power MOSFET with BJT? **[5]**

b) Explain construction & steady state characteristics of power BJT. **[7]**

c) Explain reverse recovery characteristics of a power diode. **[6]**

OR

Q2) a) Compare power diode with schottky diode. **[5]**

b) Explain construction & steady state characteristics of power MOSFET. **[7]**

c) Draw and explain Gate Drive Circuit for IGBTT. **[6]**

Q3) a) Explain construction & steady state characteristics of SCR. What is the effect of gate current? **[10]**

b) The gate triggering circuit of a SCR has a source voltage of 15V and the gate cathode characteristics has a straight line slope of 130. If gate power dissipation is 0.5W. calculate : **[6]**

i) Triggering voltage.
ii) Triggering current.
iii) Gate series resistance.

OR

P.T.O.

Q4) a) Explain construction & steady state characteristics of TRIAC with different modes of operation. **[10]**

b) Draw & explain synchronized UJT triggering circuit for SCR with waveforms **[6]**

Q5) a) A single phase semi converter is operated from 120V, 50Hz AC supply. The load resistance is 10 Ω. If the average output voltage is 25% of the maximum possible average output voltage, determine: **[6]**

i) Firing angle

ii) Average output current

iii) rms output current

b) Draw single phase fully controlled rectifier for R-L load and explain its rectifier mode & inverter mode of operations with waveforms. Also derive expressions for average output voltage. **[10]**

OR

Q6) a) What are types of AC voltage controller? Draw & explain single phase full wave AC voltage controller for R load & derive an expression for its output voltage. Also draw the following waveforms : **[10]**

i) gate pulses

ii) output voltage

iii) output current,

iv) voltage across SCR1

b) A single phase full wave ac voltage controller has a resistive load of R = 10Ω and the input voltage is Vs = 120V(rms), 50 Hz. The delay angles of thyristors T1 and T2 are equal: $\alpha 1 = \alpha 2 = \pi/2$. Determine

i) the rms output voltage & current **[6]**

ii) the input PF

SECTION - II

Q7) a) Explain basic DC chopper with R load and derive expressions for average o/p voltage & rms o/p voltage. **[10]**

b) Explain step up chopper and derive expressions for its average o/p voltage. **[8]**

OR

Q8) a) Explain I-Φ bridge inverter for R load with circuit & waveforms. Derive expression o/p rms voltage? **[8]**

b) Single phase full bridge inverter has a resistive load of R = 3Ω, dc input voltage is 48V. Calculate: **[10]**

i) rms o/p voltage & current

ii) rms o/p voltage at the fundamental frequency E1

iii) Output power Po

iv) rms o/p voltages at second (V_{o2})

v) rms o/p voltages at third harmonic (V_{o3})

Q9) a) Explain construction & working of a DC motor. **[10]**

b) Explain torque-speed & torque-current characteristics for dc series motor. **[6]**

OR

Q10)a) Explain V/F control method for an induction motor. **[8]**

b) Explain construction, working & characteristics of DC servomotor. **[8]**

Q11)a) State various protection methods for motors? Explain phase fail protection method for dc motor in detail. **[8]**

b) Draw & explain various types of 3-phase transformer connection along with relation between phase & line voltages and currents. **[8]**

OR

Q12)a) Compare stepper motor with ordinary DC motor. **[4]**

b) Explain construction, working & characteristics of BLDC motor. **[8]**

c) Compare DC motor with BLDC motor. **[4]**