5E5041

B. Tech V Sem. (Main/Back) Exam. Nov-Dec. 2015
Electrical Engineering
5EE1A Power Electronics
Common with EX (Electrical & Electronics)

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks Main: 26
Min. Passing Marks Back: 24

Instructions to Candidates:

*Attempt any **five questions**, selecting **one question from each unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

1. NIL _____   2. NIL _____

UNIT-I

Q.1 (a) Explain the working & characteristic of power transistor.   [8]

(b) Explain switching characteristics of an IGBT.   [8]

OR

Q.1 (a) Describe the basic structure of MOS controlled thyristor (MCT). Give its

equivalent circuit & explain the turn on & turn off processes.   [12]

(b) Compare power MOSFETs with BJTs.   [4]

UNIT-II

Q.2 (a) The specification sheet for an SCR gives maximum rms on state current as 35 A. If this SCR is used in a resistive circuit, compute average on state current rating for half sine wave current for conduction angles of [12]

    (i)   180°

    (ii)   90°

   (iii) 30°

  (b) Discuss thyristor protection. [4]

OR

Q.2 (a) How can we improve thyristor characteristics? [8]

  (b) Explain the construction & working of relaxation oscillator. Give necessary diagrams. [8]

UNIT-III

Q.3 (a) A dc batty is charged though a resistor R as shown in fig. Derive an expression for the average value of charging current in terms of V_m, E, R etc on the assumption that SCR is fired continuously. [12]

    (i)   For an ac source voltage of 230V, 50HZ, find the value of average charging current for R = 8Ω & E = 150V.

(ii)   Find the power supplied to battery & that dissipated in the resistor.

(iii) Calculate the supply pf
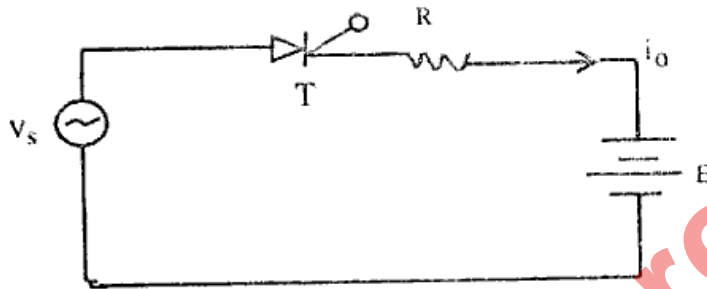
(b)   List out the application of phase controlled rectifiers.   [4]

OR

Q.3 (a)   A single phase full converter delivers power to a resistive load R for ac source voltage Vs. Show that average output Vo is gives by-

$$\left[V_o = \frac{\sqrt{2Vs}}{\Pi}(1 + \cos\alpha) \right]$$

Sketch the time variations of source voltage, output voltage, output current & voltage across one pair of SCRs. Find the circuit turn off time.   [8]

(b)   For the converter of pert (a), show that rms value of output current is given by

$$I_{or} = \frac{Vs}{R}\left[\frac{1}{\Pi}\left\{ (\Pi - \alpha) + \frac{1}{2}\sin 2\alpha \right\} \right]^{1/2}$$ [8]

UNIT-IV

Q.4 (a) Discuss the effect of source impedance on the performance of converters. [8]

(b) Discuss the mechanism of pulse width modulation control. [8]

OR

Q.4 Write short note on- [8×2=16]

(a) Extinction angle control.

(b) Symmetrical angle control.

UNIT-V

Q.5 (a) Explain principle of chopper operation. Give its control strategies. [8]

(b) For type A chopper, dc source voltage = 230V, load resistance is 10Ω. Take a voltage drop of 2V across chopper when it is on. For a duty cycle of 0.4, calculate – [8]

(i) Average & rms values of output voltage.

(ii) Chopper efficiency.

OR

Q.5 (a) Draw the circuit diagram & current wave form of multiphase chopper for phase shifted operation for $\propto = 0.50$ and $\propto = 0.60$ [8]

(b) Explain the working & circuit of Load Commutated Chopper. Give its merits & dimerits. [8]