

5E5041

B.Tech. V Semester (Main/Back) Examination, 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.)

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

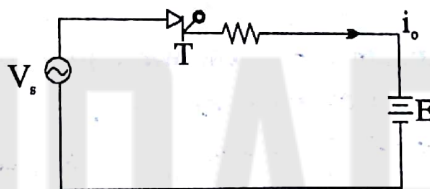
- Q.2 (a) The specification sheet for an SCR gives maximum rms on state current as 35A. If this SCR is used in a resistive circuit, compute average on state current rating for half sine wave current for conduction angles of [12]
 (i) 180°
 (ii) 90°
 (iii) 30°
 (b) Discuss thyristor protection. [4]

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 battery is charged through 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 $R=8\Omega$ & $E=150V$.
 (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 V_s . Show that average output V_o is given by-

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

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 part (a), show that rms value of output current is given by

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

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 $\alpha = 0.50$ and $\alpha = 0.60$. [8]

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