

[Total No. of Questions - 9]
(2063)

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B. Tech 4th Semester Examination

Power Electronics

EE-4004

Time : 3 Hours

Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all selecting one question from each of the Sections A, B, C & D, and all the subparts of the question in Section E.

SECTION - A

1. (a) What do you mean and ratings and protection of power semiconductor devices? Discuss different ratings and protection schemes for an SCR. **(10)**
- (b) SCRs with ratings of 2000 V and 400 A are used in a string to handle 10 kV and 3 kA. Calculate the number of series and parallel units required in case derating factor is (i) 0.1 and (ii) 0.3. **(10)**
2. (a) Discuss R and RC firing circuits with the help of neat and labelled diagrams. **(10)**
- (b) What do you mean by the commutation of an SCR? With the help of a circuit diagram and relevant waveforms, discuss the complementary commutation method. **(10)**

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SECTION - B

3. With the help of circuit diagrams and relevant waveforms, explain Y and Δ connected ac voltage controllers. (20)
4. A three-phase half-wave converter is supplying power to a resistance of 10 ohm from a three-phase star-connected 400 V, 50 Hz supply system. If it is required to obtain an average output voltage of 40% of the maximum possible output voltage, calculate (i) the firing/delay angle, (ii) the average and rms output currents, (iii) the average and rms thyristor currents, (iv) the rectification efficiency, and (v) the input power factor. Repeat the above for three-phase full-wave converter and compare the results obtain for half wave-Converter. (20)

SECTION - C

5. (a) Explain 120° and 180° conduction modes of 3-phase inverter. (14)
- (b) Briefly explain the working of series and parallel inverters. (6)
6. With the help of a neat circuit diagram, explain the working of Modified Mc-Murray-Bedford half and full bridge inverters. (20)

SECTION - D

7. (a) Find the ratio of average output voltages when dc chopper is operated in step-down mode to step-up mode for a duty cycle of 50%. (8)
- (b) Explain the working of a step-up chopper and derive the expression for its output voltage. Is this possible to operate the step-up chopper at 100% duty cycle? (12)

8. (a) Explain the working of a three-phase half wave cycloconverter. (10)
- (b) What do you mean by the circulating and none-circulating types of cycloconverters? Discuss. (10)

SECTION - E

9. Answer the following questions:
- (a) What can be the maximum value of firing/ delay angle in case of R firing circuit?
 - (b) Give the applications of pulse transformer.
 - (c) Define the extinction angle with reference to ac voltage regulators.
 - (d) Write the expression for voltage drop due to source inductance for a 1-phase converter circuit.
 - (e) Name the different power factor improvement techniques as used in ac-dc converters.
 - (f) Why diodes are connected in anti-parallel with the main switches for inverter circuit?
 - (g) On what basis, the power semiconductor switch in inverter circuit is selected?
 - (h) What is current commutated type chopper?
 - (i) Chopper circuit converts.....voltage into.....voltage.
 - (j) Can the frequency of output voltage for a cycloconverter becomes more than the frequency of input voltage? Explain. (10×2)