

Code: EE5T4

III B.Tech - I Semester – Regular Examinations – November 2015

**POWER ELECTRONICS
(ELECTRICAL & ELECTRONICS ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

Answer any FIVE questions. All questions carry equal marks

1. a) Explain the switching characteristics of power IGBTs. 7 M
b) Compare the features of Power MOSFETs with BJTs. 7 M
2. a) Describe the different modes of operation of a thyristor with the help of schematic diagram, static V-I characteristics. 7 M
b) What is an UJT? Explain how it is used for triggering an SCR through its characteristics. 7 M
3. a) Describe the parallel operation of two SCRs and explain their characteristics. 6 M
b) Ten thyristors are used in a string to withstand a dc voltage of $V_s = 15\text{KV}$. The maximum leakage current and recovery charge differences of thyristors are 10mA and 150 μF respectively. Each thyristor has a voltage sharing resistance of $C_1 = 0.5 \mu\text{F}$. Determine 8 M

- i) the maximum steady state voltage sharing,
 - ii) the steady state voltage de-rating factor,
 - iii) the maximum transient voltage sharing, and
 - iv) the transient voltage de-rating factor.
4. a) Describe the operation of a single phase semi converter with RL load with corresponding waveforms. 7 M
- b) A DC battery is charged through a resistor R, by a single phase, one-pulse thyristor controlled rectifier. For an ac source voltage of 230V, 50Hz, find the value of average charging current for $R = 10\Omega$, $E = 110V$ and firing angle delay is 30° . Also calculate the power delivered to the battery and that dissipated in the resistor. 7 M
5. a) Explain the operation of 3- Φ , three pulse converter with R-load. Draw the relevant waveforms and derive the expression for average load voltage. 7 M
- b) Explain the effect of source inductance on the performance of a three-phase fully controlled bridge converter. Draw the relevant wave forms. 7 M
6. a) A single-phase, full wave, ac voltage regulator has an input voltage of 250V (rms) and a load of 50 ohm resistance. The delay angle of each thyristor is 90° . Find rms output voltage, load current and average thyristor current. Sketch

the wave shapes of output voltage, load current, current through the thyristor and voltage across the thyristor. 7 M

b) With the help of circuit diagram and waveforms explain the operation of 1- Φ to 1- Φ step down cyclo converter. 7 M

7. a) What are the various control strategies for varying duty Cycle? Explain them neatly. 7 M

b) Draw the schematics of step-down and step-up choppers and derive an expression for output voltage in terms of duty cycle for a step up and step down chopper. 7 M

8. a) Single phase half bridge inverter has a resistive load of $R = 3$ ohms and dc input voltage $E_{dc} = 50V$. Calculate
i) rms output voltage at fundamental frequency E_1
ii) the output power
iii) average and peak current of each thyristor

6 M

b) Explain about simple SCR series inverter circuit and its limitations. 8 M