Printed Pages—4　　　　　　　　　　　　　　　　**TEE603**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2061　　Roll No. | | | | | | | | | | |

B. Tech.

(SEM. VI) THEORY EXAMINATION 2010-11

POWER ELECTRONICS

Time : 3 Hours　　　　　　　　　　　　　　*Total Marks : 100*

Note :—Attempt **ALL** questions.

1. Solve any **four** parts of the following :—　　**(5×4=20)**

   (a) Describe with neat diagram the working of a depletion type n-channel MOSFET. Also draw its transfer characteristics.

   (b) Explain turn off characteristics of a thyristor and explain why a reverse voltage is developed across a thyristor during turn-off.

   (c) Calculate the number of SCRs, each with rating of 500 V, 75 A required in each branch of a series and parallel combination of a circuit with the total voltage and current rating of 7.5 kV and 1000 A. Assume derating factor of 12%.

   (d) Explain with neat circuit diagram the UJT trigger circuit for a thyristor.

   (e) Discuss the turn-off process in a GTO with the help of appropriate voltage and current waveforms.

   (f) Discuss with a circuit diagram the operation of BJT as a switch. Also explain the secondary breakdown phenomena of the transistor.

2. Solve any **two** parts of the following :—   **(10×2=20)**

  (a) For a given SCR the gate cathode characteristics has a spread given by the equations :

     $I_g = mV^2$ and $I_g = mV^{3/2}$, where I_g is in mA, V in volts, m = 2.

     The gate source voltage is 15 V, and the load line has a slope of –112.5 V/amp, calculate :

     (i) Series resistance to be connected in the gate circuit.

     (ii) Trigger voltage V_{GT} and trigger current I_{GT} given that average gate power dissipation is 0.5 Watt.

  (b) In an ideal type A chopper circuit, the supply voltage is 250 V, chopping frequency is 300 Hz, duty cycle = 0.5, load resistance is 5 Ω and load inductance is 5 mH. If the load has a back emf of 100 V, find the average output current of the chopper. Also find the maximum and minimum values of steady state output current, and the average value of source current.

  (c) Explain the requirement of commutation circuit for thyristor and describe impulse commutation circuit with appropriate waveforms.

3. Solve any **two** parts of the following :   **(10×2=20)**

  (a) Justify the statement with relevant waveforms and expressions "the effect of source inductance is to reduce the average output voltage from its normal value if single phase full converter is supplying power to R-L load."

(b) A single phase half-wave controlled rectifier with freewheeling diode is used to supply heavily inductive load from a 220 V ac supply. Assuming the load current to be 10 A, find the average load voltage for a firing angle of 45°. What is the load resistance ? If the firing angle is made 120°, does the load voltage become negative ?

(c) Describe three phase half controlled bridge rectifier with highly inductive load. Also draw the relevant output waveforms.

4. Solve any **two** parts of the following : $(10×2=20)$

(a) Discuss the operation of single phase ac regulator with R-L load when firing angle α is less than or equal to, load phase angle ϕ. Hence show that for α less than ϕ, the output voltage of ac regulator cannot be regulated.

(b) A single phase full-wave ac regulator has a resistive load of 5 Ω while the input voltage is 220 V, 50 Hz. If the required load power be 7.5 kW, find the fire angle of the thyristors. What is the rms output voltage ? Find also the input power factor.

(c) Dicuss with neat circuit diagram and relevant waveforms the working of single phase to single phase bridge type cycloconverter with R-L load.

5. Solve any **two** parts of the following : $(10 \times 2 = 20)$

(a) Discuss with neat circuit diagram the working of three phase bridge inverter for 180° conduction of a thyristor with three phase balanced star connected resistive load. Also state its merits and demerits.

(b) Describe with neat circuit diagram and relevant waveforms basic single phase resonant inverter. Also derive the expressions for capacitor voltage under different modes of operation.

(c) What is pulse width modulation ? How this technique control the output voltage of the inverters ?

     A single phase full bridge inverter has rms value of fundamental component of output voltage, with single-pulse modulation, equal to 110 V. Compute the pulse width required and the rms value of output voltage in case dc source voltage is 220 V.