*Seat No.: _____* *Enrolment No._____*

# GUJARAT TECHNOLOGICAL UNIVERSITY

**M. E. - SEMESTER – I • EXAMINATION – WINTER • 2013**

**Subject code: 712907N** **Date: 30-12-2013**

**Subject Name: Power Devices & Applications**

**Time: 10.30 am – 01.00 pm** **Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

**Q.1** **(a)** Explain V-I characteristics of Power BJT in various operating regions. Enlist various differences between Power BJT and Signal BJT. **07**

**(b)** An SCR has Vg-Ig characteristics given as Vg = 1.5+8Ig. In a certain application, the gate voltage consists of rectangular pulses of 12V and of duration 50μs with 20% duty cycle. Determine the value of series resistor (Rg) in gate circuit to limit the peak power dissipation in the gate to 5W. Also calculate average power dissipation in the gate. **07**

**Q.2** **(a)** Explain the basic structure of an IGBT and briefly explain its principle of operation with neat diagram. **07**

**(b)** Explain the construction and the V-I characteristics of a PUT. **07**

**OR**

**(b)** Explain the application of PUT to trigger an SCR. **07**

**Q.3** **(a)** Explain Class-A commutation of SCR with necessary waveforms. Also enlist its drawbacks. **07**

**(b)** Briefly explain the various turn on methods for SCR. Which method is preferable? Justify. **07**

**OR**

**Q.3** **(a)** Explain two-transistor equivalent model of SCR. Also derive the equation for the anode current. **07**

**(b)** Explain di/dt and dv/dt protection circuits. **07**

**Q.4** **(a)** Compare SCR, Power BJT, Power MOSFET and IGBT in a tabular form. **07**

**(b)** A Class-C commutation circuit has both the resistances are of 10Ω, commutation capacitor is of 5μF and supply voltage is 200V. Turn OFF time of both the SCRs is 50μs. Make necessary calculations and state whether the circuit components are correct for satisfactory commutation of SCRs. If not then suggest the solution. **07**

**OR**

**Q.4** **(a)** Explain power circuit of ideal zero voltage switch with neat diagram and necessary waveform. **07**

**(b)** Why battery charging is needed? Draw and explain battery charging circuit. **07**

**Q.5** **(a)** Enlist the applications of UPS. What is the meaning of Online UPS and Offline UPS? Explain any one of them with neat block diagram. **07**

**(b)** Compare R, RC and UJT firing circuits in tabular form. What is the major technical drawback of R triggering circuit? Why? **07**

**OR**

**Q.5** **(a)** Explain the working principle of a 1-phase light dimmer with power saving **07**

feature. Also derive the RMS output voltage equation.

**(b)** How SUS differs from SBS? Draw their circuit symbols. Explain any one of them with neat diagram. **07**

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