

**Total No. of Questions : 08**

**M.Tech.(EE) (2013 Onwards) (Sem.-1)**  
**ADVANCED POWER ELECTRONICS**  
**Subject Code : MTEE-102**  
**Paper ID : [E1365]**

**Time : 3 Hrs.**

**Max. Marks : 100**

**INSTRUCTION TO CANDIDATES :**

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWENTY marks.

1.
  - a) Draw various characteristics of a GTO while explaining each term used in it. Mention its variants with their applications. (8)
  - b) Draw the characteristics of a MOSFET and explain the physical significance of various terms used in it. (6)
  - c) Explain with the help of depletion layer and majority carrier concept, the conduction and blocking state of a pn junction. (6)
2.
  - a) What are the problems in operation of series and parallel connected thyristors and how these problems are tackled? (6)
  - b) Draw the schematic diagrams of gate firing circuits for a thyristor and explain their operation. (6)
  - c) A thyristor operating on a peak supply voltage of 400V has the following specifications : (8)  
  
Repetitive Peak Current  $I_p = 100A$ ,  $(di/dt)_{max.} = 50A/\mu S$ ,  $(dv/dt)_{max.} = 200V/\mu S$   
Considering the safety factor of 2 for all the above mentioned parameters, design a suitable snubber circuit. The minimum value of load resistance is  $20\Omega$ . Consider the value of damping ratio/factor  $\xi = 0.6$ .
3.
  - a) Differentiate between IGCT and IGBT. Suggest at-least two suitable applications of each. (6)
  - b) Discuss the input, output and transfer characteristics of an IGBT for various applications and their limitations. (10)
  - c) What do you understand by  $di/dt$  and  $dv/dt$  ratings of a thyristor? (4)

4. Draw a comparison table for various power electronic switches based on the power rating, frequency, ease of control, switching losses and cost/applications. (20)
5.
  - a) Draw the equivalent circuit of a MOS controlled thyristor and explain its operation. (10)
  - b) Why Diodes need snubber circuits? Explain operation of over voltage snubber circuit. (10)
6. Emphasize on the need of drive circuits and explain various drive circuits required for the power electronic systems. (20)
7.
  - a) What is the significance of isolation and amplification circuits in a drive? (5)
  - b) What is the significance of PIV ratings of a power electronic device? (5)
  - c) How the Transient characteristic affects operation of a power electronic switch? (5)
  - d) How the junction temperature affects the rating of a power electronic device? (5)
8. Write short notes on **any two** of the following : (10 × 2)
  - a) Cascade connected drive circuits
  - b) Heat sink designs for power electronic switches
  - c) Circuit layout considerations