Register Number.....

M.E. DEGREE EXAMINATIONS: DECEMBER– 2008

First Semester

POWER ELECTRONICS AND DRIVES

P07PE102 Advanced Power Semiconductor Devices

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (20 × 1 = 20 Marks)

1 The characteristics of a Power diode is
a. uncontrolled turn on and turn off
b. uncontrolled turn on and controlled turn off
c. controlled turn on and controlled turn off
d. controlled turn on and uncontrolled turn off

2 Which is the semiconductor device having high switching speed
a. Power diode
b. SCR
c. MOSFET
d. IGBT

3 The peak negative current flowing through a power diode during turn off is called as
a. forward recovery current
b. reverse recovery current
c. feedback current
d. peak reverse current

4 For a given forward current the reverse recovery current of a Power Diode _____ with the rate of decrease of the forward current.
a. becomes constant
b. increases
c. decreases
d. becomes zero

5 When the base-emitter junction of a BJT is forward biased while the base-collector junction is reverse biased the BJT is said to be in the
a. saturation region
b. cutoff region
c. passive region
d. active region

6 Secondary breakdown in a Power BJT occurs due to
a. uniform distribution of emitter current
b. non uniform distribution of emitter current
c. uniform distribution of collector current
d. non uniform distribution of collector current

7 The constructional features of a thyristor has
a. four layers and three junctions
a. three layers and two junctions
a. two layers and one junction
a. only one layer and no junction

8 During rise time the rate of rise of anode current in a thyristor should be limited to avoid
a. turn on the device
b. turn off the device
c. creating local hotspots
d. breakdown

9. The current conduction in a MOSFET occurs by flow of electron from the
a. drain to the source through n type channel
b. source to the drain through n type channel
c. drain to the source through p type channel
d. source to the drain through p type channel

10. The Gate terminal of a MOSFET is isolated from the semiconductor by a thin layer of
    a. NaO_2 b. lightly doped Si
    c. SiO_2 d. heavily doped Si

11. An IGBT is a device which has combining advantages of
    a. Power diode and BJT b. BJT and MOSFET
    c. MOSFET and GTO d. GTO and RCT

12 GTO is a
    a. current controlled minority carrier device b. current controlled majority carrier device
    c. voltage controlled minority carrier device d. voltage controlled majority carrier device

13. Snubber circuits are used in thyristors to protect the device against
    a. over voltage spikes b. over current
    c. excessive temperature rise d. gate under voltage

14. Which of the following device has excellent internal thermal capacity
    a. IGBT b. MOSFET
    c. GTO d. SCR

15. The main use of pulse transformer in firing circuit is to
    a. isolate power circuit from gate drive circuit b. isolate gate drive circuit from power circuit
    c. increase the current carrying capacity d. decrease the current carrying capacity

16. Pulse transformers are particularly useful for triggering
    a. IGBT b. BJT
    c. SCR d. MOSFET

17. The mechanical transport of heat by a moving fluid or gas is called as
    a. conduction b. heat radiation
    c. electro magnetic radiation d. convection

18. The electrical analogy of thermal power or rate of heat transfer is
    a. current b. potential difference
    c. electrical resistance d. electrical power

19. A power semiconductor device dissipates 100W for operating conditions for which the data sheet specifies a maximum case temperature of 95˚C. If the ambient temperature is 35˚C, the heat sink thermal resistance is
    a. 0.95˚C/W b. 035˚C/W
    c. 1.3˚C/W d. 0.6˚C/W

20. Which of the following mounting techniques is used for thyristors of high current ratings
    a. stud mounting b. lead mounting
    c. pressure mounting d. bolt down mounting

2

21

22

22.1

23.a

23.b

24.a)

24.b)

25.a)

25.b)

Part B (5 x 16 = 80 Marks)

21.a)	i).	Explain with a neat diagram the reverse recovery and turn-off process in a pn junction power diode.	(10)
	ii).	Describe the various power electronics devices with a block diagram.	(6)

(OR)

21.b)	i).	Describe the forward and reverse bias characteristics of power a power diode.	(10)
	ii).	Write short notes on switching losses.	(6)
22.a)	i).	Describe the input and output characteristics of a CE Bipolar Junction Transistor	(10)
	ii).	Compare BJT and Thyristor.	(6)

(OR)

22.b) Draw the two transistor model of a thyristor and derive the condition for regenerative switching action.

23.a) Draw the circuit model of a power MOSFET and analyze its switching characteristics.

(OR)

23.b) Draw the circuit model of a power IGBT and analyze its switching characteristics.

24.a) What is the necessity of isolation for firing circuits and describe with a neat diagram the working of pulse transformer and optocoupler.

(OR)

24.b) Describe the over voltage and over current protection of power switching devices with necessary diagrams.

25.a)	i).	Describe the various heat transfer techniques.	(8)
	ii).	Describe the electrical analogy of thermal components.	(8)

(OR)

25.b) Explain the different types of mounting techniques.

****