QP Code: R251B042 | Reg. No | | | | | | | | | | | AY 24

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

M.Tech. (First Semester) Regular Examinations, February – 2025

24MPEPE11021 – Power Semiconductor Devices and Modelling

(Power Electronics)

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions		CO #	Blooms Level
a.	What are some common applications of power semiconductor devices in daily life?	CO1	K1
b.	Why is the Insulated Gate Bipolar Transistor (IGBT) widely used in modern applications?	CO2	K1
c.	What was the major drawback of the first-generation IGBT technology?	CO3	K2
d.	What is a snubber circuit, and why is it essential in power electronics?	CO4	K2
e.	What are the different types of power losses occurring in a thyristor during operation?	CO2	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions		Marks	CO #	Blooms Level
2. a.	Describe the working of a Schottky diode, highlighting the importance of its ohmic contacts.	5	CO1	K2
b.	Illustrate and explain the V-I characteristics of an Insulated Gate Bipolar Transistor (IGBT).	5	CO1	K3
	(OR)			
c.	With a neat diagram, discuss the structural composition of a power Bipolar Junction Transistor (BJT).	5	CO1	K1
d.	Explain the switching behavior of a BJT and its significance in power electronics applications.	5	CO1	K3
3.a.	What are overvoltage and overcurrent protection mechanisms in power semiconductor devices? Explain their necessity.	5	CO2	K2
b.	Define second breakdown in power devices and describe the concept of Forward-Biased Safe Operating Area (FBSOA).	5	CO2	K4
	(OR)			
c.	What critical considerations should be taken into account when operating MOSFETs in parallel?	5	CO2	K4
d.	Draw and explain the switching characteristics of a power diode.	5	CO2	K3
4.a.	Describe the key functional elements in Eber-Moll's transistor model with a supporting diagram.	5	CO3	K2
b.	What are snubber circuits, and why are they required in diodes? Explain their working principles.	5	CO3	K3
	(OR)			
c.	With an appropriate diagram, explain the construction and switching performance of a Gate Turn-Off Thyristor (GTO).	5	CO3	K2
d.	Discuss various techniques used for triggering an SCR effectively.	5	CO3	K3

5.a.	What methods are employed to enhance the di/dt capability of a thyristor?	5	CO4	K4
b.	Explain the role of heat sinks in power semiconductor circuits and discuss key factors for their sizing	5	CO4	K3
	(OR)			
c.	Discuss how a MOSFET turns on with an appropriate example illustrating the process.	5	CO4	K1
d.	Explain in detail the turn-on and turn-off operations of a thyristor.	5	CO4	K2
6.a.	Describe the design methodology for magnetic components used in power electronics: (i) Line frequency inductors (ii) High-frequency inductors	5	CO2	K3
b.	Differentiate between the following electrical breakdown phenomena:(i) Avalanche breakdown, (ii) Punch-through voltage, (iii) Zener breakdown	5	CO1	K3
	(OR)			
c.	Explain latch-up in IGBTs and discuss methods to prevent it.	5	CO1	K1
d.	Compare and contrast enhancement-mode and depletion-mode MOSFETs in terms of operation and applications.	5	CO3	K3

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