Total number of printed pages: 2

DIPLOMA (D) / V / DIE504

2023

POWER ELECTRONICS

Full Marks: 100

Time: Three hours

The figures in the margin indicate full marks for the questions.

*Answer all **five** questions.*

1. a) Answer the following questions in brief- 10 X 2 = 20

i) "The resistance of n^+ semiconductor region is less than n^- semiconductor region." Justify.

ii) Define the term "semiconductor junction".

iii) What is a semi-controllable semiconductor switch?

iv) Define Softness Factor of a diode.

v) Why is MOSFET called a unipolar device?

vi) What do you mean by Forward Breakover voltage of a thyristor?

vii) What is the relation between ∞ and β of a transistor?

viii) Define the term "Duty Cycle".

ix) What is the turn-on voltage of a PUT?

x) Name any two applications of a thyristor.

2. a) What is the function of the drift region found in a power diode? Briefly explain how it affects the characteristic of a diode. 3

b) Explain the different modes of operation of an SCR with the help of its static I-V characteristics. 5

c) Describe the various methods of turning ON a SCR. 5

d) Draw the structure of a power MOSFET clearly showing the parasitic BJT and parasitic diode in it. 5

e) State four differences between BJT and MOSFET. 2

3. a) What is a firing circuit? Draw the circuit diagram of Resistance firing circuit of a thyristor and show the relation between the firing angle, resistances and Gate turn-on voltage. Why is the firing angle of Resistance based circuit limited to 90°? — 2 + 6 + 2 = 10

b) State the intrinsic stand-off ratio of a Unijunction transistor. — 2

c) With the help of voltage and current waveforms, explain the working of a single-phase half-wave circuit with R-L load. — 8

d)

4. a) What is the main function of a DC chopper? Deduce the output voltage expression for an elementary chopper circuit. — 6

b) Describe the various control strategies for varying the duty cycle of a chopper. — 6

c) What is an inverter? Draw the circuit diagram of a single phase full-bridge inverter and explain its working. — 8

5. a) Write short notes on any four. — 5 X 4 = 20

i. GTO ii. Triac iii. IGBT iv. PUT

v. BJT as a switch vi. Two transistor model of thyristor