Paper id: 250668

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM VI) THEORY EXAMINATION 2024-25
POWER ELECTRONICS

TIME: 3 HRS **M.MARKS: 100**

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Q No.	Question	CO	Level
a.	List the types of power diodes based on reverse recovery characteristics.	1	K1
b.	Compare the IGBT and MOSFET operation.	1	K1
c.	Draw the forward gate characteristics of a thyristor.	2	K2
d.	Explain the need of commutation in thyristor circuit.	2	K2
e.	Give at least five applications of phase-controlled rectifiers.	3	K1
f.	What is the effect of freewheeling diode in a half-wave rectifier circuit?	3	K2
g.	Write the difference between cyclo-converter and DC link converter.	4	K2
h.	What are the control strategies for regulating the power flow in ac voltage controllers?	4	K1
i.	What are the characteristics of good inverter?	5	K2
j.	What do you understand by distortion factor?	5	K2

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

Q No.	Question	CO	Level
a.	Describe the working of IGBT and explain its switching characteristics.	1	K2
b.	Illustrate a basic layout of the firing circuit for SCRs. Describe the resistance-triggered firing method of an SCR in a half-wave circuit with a DC load, considering various firing angles, and sketch the corresponding waveform	2	K3
c.	A single-phase half-wave SCR circuit feeds power to resistive load. Draw waveforms for voltage and current and obtain expression for average and rms load voltages in terms of source voltage and firing angle.	3	K3
d.	Discuss the principle of phase control in single-phase full wave ac voltage controller. Derive expression for the rms value of its output voltage.	4	K3
e.	What is the purpose of connecting diodes in anti-parallel with thyristors in inverter circuit? Explain how these diodes come into play.	5	K4

SECTION C

3. Attempt any *one* part of the following: **10 x 1 = 10**

Q No.	Question	CO	Level
a.	Describe the different modes of operation of a thyristor with the help of its static I-V characteristics.	2	K2
b.	With the help of schematic diagram, explain the working of a switched mode power supply. What are the advantage and disadvantage of SMPS over linear power supplies?	2	K3

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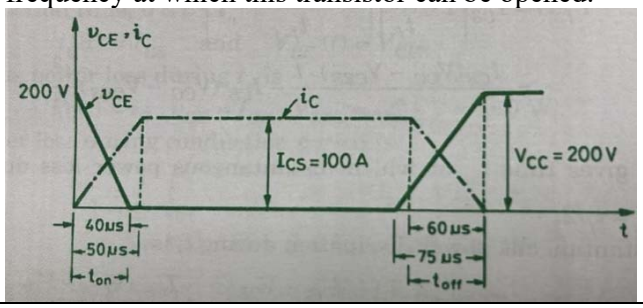
4. Attempt any *one* part of the following: 10 x 1 = 10

Q No.	Question	CO	Level
a.	A power transistor has its switching waveforms as shown below. If the average power loss in transistor is limited to 300 W, find the switching frequency at which this transistor can be opened. 	1	K2
b.	Explain the constructional details and working of low-power MOSFET and power MOSFET and bring out the difference between the two.	1	K2

5. Attempt any *one* part of the following: 10 x 1 = 10

Q No.	Question	CO	Level
a.	What is the dual converter? Explain the various modes of operation of dual converter with suitable diagram.	3	K2
b.	A single phase 230 V, 1 kW heater is connected across 1-phase, 230 V, 50 Hz supply through an SCR. For firing angle delays of 45^0 and 90^0, Calculate the power absorbed in the heater element.	3	K3

6. Attempt any *one* part of the following: 10 x 1 = 10

Q No.	Question	CO	Level
a.	Describe the principle of burst firing for a single-phase ac voltage controller. Derive an expression for the rms value of output voltage.	4	K2
b.	A single phase voltage controller has input voltage of 230 V, 50 Hz and a load of R=15 ohm for 6 cycles on an 4 cycles off, determine (a) rms output voltage, (b) input power factor (c) average and rms thyristor currents.	4	K3

7. Attempt any *one* part of the following: 10 x 1 = 10

Q No.	Question	CO	Level
a.	A single phase half bridge PWM inverter has input dc voltage =230 V and fundamental output frequency =50 Hz. For carrier frequency of 1.05 kHz and modulation index=0.8, calculate (a) frequency modulation index (b) pulses per cycle (c) rms value of fundamental output voltage (d) distortion factor THD	5	K3
b.	What is pulse width modulation? List the various commonly used PWM techniques. How do these differ from each other?	5	K2