Ref No. : Ex/EE/PC/B/T/314/2024

Bachelor of Electrical Engineering, 3rd Year 1st Sem. Exam, 2023

SUBJECT : POWER ELECTRONICS

Time: Three Hours | Full Marks: 100 (50 each part)

Use a separate Answer-Script for each part

PART - I

Answer question no. 3 and any two from the rest

Question No.			Marks
1.	(a)	Discuss the circuit equivalent of a power diode with the help of its I-V characteristics	4+4+4+4
	(b)	Discuss the constructional modifications in power diode from a signal diode	
	(c)	Reverse recovery phenomenon is shown by all junction devices- Justify	
	(d)	What is the basic difference between PN junction diode and Schottky diode?	
2.	(a)	Discuss a few important parameters of Power BJT.	6+6+4
	(b)	Draw and explain negative base drive of a Power BJT.	
	(c)	Sketch the structure of a power MOSFET and explain its working principle. Why power MOSFET cannot block any reverse voltage? What is SOA? Explain it for Power BJT	
3.	(a)	Explain energy balance equation for Buck-Boost Converter with the help of appropriate circuit.	4+4+10
	(b)	Explain the Current Limit Control technique for converters.	
	(c)	A step-down DC-DC converter is to feeding a purely resistive load of 10 Ω. If the input of the converter is 220 V and load current is 10 A, find out the duty cycle needed. If the converter is controlled by a PWM determine the control DC voltage if the carrier (saw-tooth) signal has 2 kHz frequency and 24 V amplitude.	

[Turn over

Use a separate Answer-Script for each part

Question No.	PART - I	Marks
4.(a)	With the help of a circuit diagram explain the working principle of a push-pull inverter. Explain how average voltage is controlled. What are the advantage and disadvantage of this inverter?	**6+6+4**
(b)	Explain two modes of operation of a full bride inverter.	
(c)	Draw and explain gate drive circuit of a thyristor.	
5.	Write short notes on (any two)	**8x2**
(a)	Construction and operation of Power MOSFET	
(b)	Ideal properties of an ON-OFF controller	

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B.E. ELECTRICAL ENGINEERING THIRD YEAR FIRST SEMESTER EXAM 2024

SUBJECT: - POWER ELECTRONICS

Full Marks: 100

Time: Three hours (**50** marks for this part)

Use a separate Answer-Script for each part

No. of Questions	PART -II Answer any Three Questions All symbols used have their usual significance (Two marks are reserved for neatness)	Marks
1)	Describe the principle of operation of a single phase full wave Diode Rectifier using center tapped transformer and show the following waveforms assuming the load to be resistive: (i) Output voltage, (ii) Load current, (iii) Diode voltage. For the above rectifier also determine: (iv) Average output voltage, (v) Output RMS voltage (vi) Efficiency (vii) Form factor, and (viii) Transformer utilization factor.	(16)
2)	Describe with drawing the relevant circuits, wave forms of input(phase) voltages and output voltage and current, the **working principle of a Three-phase half-wave uncontrolled rectifier** having 3 no. of Diodes supplied from a star-3-phase source voltages having a resistive load at the output; determine the expression for i) average dc output voltage and ii) R.M.S. output voltage. Also draw wave forms of voltage across any one of Diodes. Explain why it is called three pulse rectifier and also mention the sequence of conduction of diodes.	(12+4) =16
3)	Describe with drawing the relevant circuits, wave forms of input voltages and output voltage and current, the working principle of a **Three phase full Wave controlled rectifier** having **6 no. of SCR** supplied from a 3-phase source voltage, feeding a "R" load with triggering angle $\alpha = 30°$ of the SCR; also determine the expression for i) average dc output voltage and ii) R.M.S. output voltage. Also show with relevant waveforms the sequence of conduction of 6 no. of SCR.	(12+4) =16
4)	Describe with drawing the relevant circuits, wave forms of input voltages and output voltage and current, the working principle of a **Three phase Semi-Converter** having **3 no. of SCR** and **3 no. of Diodes** supplied from a three-phase source voltage which is feeding a "R" load with any triggering angle α of the SCR; determine the expression for i) average dc output voltage and ii) R.M.S. output voltage. Also show with relevant waveforms the sequence of conduction of SCR and Diodes.	(12+4) =16

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Time: Three hours (**50** marks for this part)

5)	Write short notes on any *two* of the following: (i) Single phase full wave **uncontrolled** rectifier feeding R-L-E load. (ii) Single phase fully **controlled** bridge rectifier with R-L load having free wheeling diode. (iii) Single phase half wave **uncontrolled** rectifier feeding R load having filter capacitor C across load.	(8×2) =16