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

Bachelor of Electrical Engineering, 3rd Year 1st Semester Supplementary Examination, 2024

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)	What reverse recovery phenomenon in a power diode?	4+5+3+4
(b)	Classify power diodes according to their reverse recovery time. What are SRD and HRD? Which one is preferred in real life and why?	
(c)	Show how average power loss in a power diode is calculated from its equivalent circuit.	
(d)	What is schottky diode? What are the advantages and disadvantages of it?	
2.(a)	Why power BJT is operated in the quasi-saturation region?	3+5+8
(b)	Explain with the help of circuit diagram how quasi-saturation is implemented?	
(c)	Sketch the structure of a power MOSFET and explain its working principle. Why power MOSFET cannot block any reverse voltage?	
3. (a)	Explain with the help of circuit diagram the working principle of non-isolated Boost DC-DC converter.	5+3+10
(b)	Why PWM technique is preferred over FM technique for controlling the duty cycle?	
(c)	A step-down DC-DC converter is to fed a purely resistive load of 5 Ω. If the input of the converter is 120 V and load current is 10 A, find out the duty cycle needed. If the ON time of the converter is 40 μs, determine the switching frequency.	

[Turn over

Use a separate Answer-Script for each part

Question No.	PART - I	Marks
4.(a)	Explain with the help of a circuit diagram the working principle of a full-bridge inverter for distortion-less output voltage in case of an inductive load.	**8+8**
(B)	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?	
5.	Write short notes on (any two)	**8x2**
(a)	IGBT	
(b)	Power losses in semiconductor devices	
(c)	dV/dt and di/dt protection in SCR	

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

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Full Marks: 100

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

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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 uncontrolled full wave bridge rectifier with R load and show waveforms of the following: i) Output voltage ii) Load current iii) Diode current iv) Input Line current, and (v) diode voltage. For the above rectifier also determine: (vi) Average output voltage, (vii) Load RMS voltage (viii) Form Factor (ix) Efficiency.	(16)
2)	(a)	Explain with relevant circuit diagrams and waveforms the operation of a **single-phase half-wave uncontrolled rectifier** feeding an R-L load having a freewheeling diode. Also, draw the waveform of the load current of this circuit.	(8)
	(b)	If the **single-phase half-wave uncontrolled rectifier** is connected with a 230 V,50 Hz A.C supply and the R-L load has the value of R = 100 Ω and L = 0.1H, determine (i) average load current (ii) r.m.s load current, and (iii) the power absorbed by the resistor. Assume the load current conducting up to 40^0 beyond voltage zero crossing to negative.	(8)
3)		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 controlled rectifier** having 3 no. of SCR supplied from a star-3-phase source voltages having a resistive load at the output for a triggering angle α; 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 SCRs.	(16)
4)		Describe by drawing the relevant circuits, waveforms of input voltages and output voltage and current, the working principle of a **Three phase full Wave uncontrolled rectifier** having 6 no. of Diodes supplied from 3-phase source voltages, feeding an "R" load; also determine the expression for i) average dc output voltage and ii) R.M.S. output	(16)

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	voltage. Explain why it is called six pulse rectifier and also mention the sequence of conduction of diodes.	
5)	Write short notes on any ***two*** of the following: (i) Single phase half wave **uncontrolled** rectifier feeding Resistive load having filter capacitor C in parallel across the load. (ii) Single phase semi converter feeding an R-L load. (iii) Single phase full wave uncontrolled rectifier with R-L-E load.	(8×2) =16