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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: V**

Branch: Electrical and Electronics Engineering **Duration: 3 hrs.**

Course Code: 23EE5PCPEN **Max Marks: 100**

Course: Power Electronics

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	CO	PO	Marks
1	a)		What is the importance of performance parameters of a diode rectifier? Enlist the performance parameters with their definitions and expressions.	*CO2*	*PO1, PO 2*	**10**
	b)		How is a power diode different from normal (signal) diode? Describe in terms of structure and characteristics. Draw and explain the reverse recovery characteristics of a power diode	*CO1*	*PO2*	**10**
			OR			
2	a)		List the advantages of SiC as a material for power semiconductor device.	*CO1*	*PO2*	**04**
	b)		Obtain the expressions for peak recovery time and reverse recovery current of a power diode	*CO2*	*PO1,PO2*	**06**
	c)		Draw the circuit diagram and waveforms of a single-phase bridge rectifier that supplies a very high inductive load such as a dc motor. The load is such that the motor draws a ripple-free armature current of Ia. Derive the expression for Ia and determine (a) the HF of input current and (b) the input PF of the rectifier.	*CO3*	*PO2*	**10**
			UNIT - II			
3	a)		Draw the structural diagrams of Enhancement type and depletion type MOSFETS. List the major differences between the two types.	*CO1*	*PO2*	**10**
	b)		With a neat cross-sectional diagram discuss the working of IGBT. Plot the static characteristics	CO1	PO2	**10**
			OR			
4	a)		Which type of MOSFET is ideal for switching applications? Give reason	CO1	PO2	**04**

		b)	With switching models and waveforms, explain the switching characteristics of MOSFET	CO2	PO1,PO2	**12**
		c)	In a certain application, a power converter of rating 250W with a high efficiency is required. Which power device will you choose for this application if the switching frequency of the devices to be selected as 150kHz. Justify your answer.	CO2	PO1,PO2	**04**
			UNIT - III			
	5	a)	Explain the construction and working of an SCR. Obtain an expression for anode current with the help of its two-transistor analogy.	*CO1*	*PO2*	**10**
		b)	With relevant circuit diagram and waveforms explain single full controlled converter for R-L load. Derive the expressions for average and rms output voltages and output current	*CO3*	*PO2*	**10**
			OR			
	6	a)	With neat circuit diagram and waveform, analyse the working of a three phase full converter. Derive expressions for average and RMS output voltages	*CO3*	*PO2*	**10**
		b)	A single-phase full converter is fed from a 230V, 50Hz supply. The load is highly inductive. Find the average load voltage and load current if the load resistance is 10 ohm and firing angle is 45°. Draw the circuit diagram and sketch the output voltage waveform	*CO4*	*PO3*	**10**
			UNIT - IV			
	7	a)	The buck regulator has an input voltage of Vs = 12 V. The required average output voltage is Va = 5 V at R = 500Ω and the peak-to-peak output ripple voltage is 20 mV. The switching frequency is 25 kHz. If the peak-to-peak ripple current of inductor is limited to 0.8 A, determine (a) the duty cycle k, (b) the filter inductance L, (c) the filter capacitor C, and (d) the critical values of L and C.	*CO4*	*PO3*	**10**
		b)	What are the advantages of isolated DC-DC converters compared to their non-isolated counterparts? With a neat circuit diagram and waveforms, illustrate the working of a flyback converter.	*CO3*	*PO2*	**10**
			OR			
	8	a)	The buck–boost regulator has an input voltage of Vs = 12 V. The duty cycle k = 0.25 and the switching frequency is 25 kHz. The inductance L = 150 µH and filter capacitance C = 220 µF. The average load current Ia = 1.25 A. Determine (i) the average output voltage, Va; (ii) the peak-to-peak output voltage ripple, ΔVc; (iii) the peak-to-peak ripple current of inductor, ΔI; (iv) the peak current of the transistor, Ip; and (v) the critical values of L and C.	*CO4*	*PO3*	**10**
		b)	What are the advantages of resonant converters? With a neat circuit diagram and waveforms, illustrate the working of a ZVS DC-DC converter	*CO3*	*PO2*	**10**

			UNIT - V			
	9	a)	Explain the operation of a 3-phase bridge inverter with star connected resistive load. Sketch the gating signal and line to line output voltage for 180° conduction mode.	*CO3*	*PO2*	**10**
		b)	With a neat circuit diagram illustrate the working principle of five level diode clamped multilevel inverter	*CO3*	*PO2*	**10**
			OR			
	10	a)	A single-phase full bridge inverter has a resistive load of 2.4 Ohm and the d.c. input voltage of 48 V. Determine:- (i) RMS output voltage at the fundamental frequency (ii) Output power P_o (iii) Average and peak currents of each transistor (iv) Peak blocking voltage of each transistor. (v) Total harmonic distortion and distortion factor. (vi) Harmonic factor and distortion factor at the lowest order harmonic.	*CO4*	*PO3*	**10**
		b)	With a neat circuit diagram and waveforms, illustrate the working of Current Source Inverter	*CO3*	*PO2*	**10**

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