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

Autonomous Institute Affiliated to VTU

January / February 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)		Explain with a neat waveform any two types of power electronic circuits.	*CO1*	*PO2*	**06**
	b)		Explain diode (p-n junction) characteristics	*CO1*	*PO2*	**07**
	c)		Explain reverse recovery characteristics of a Diode.	*CO1*	*PO2*	**07**
			OR			
2	a)		Explain the operation of single-phase diode bridge rectifier with R load along with waveform	*CO3*	*PO2*	**07**
	b)		A three-phase bridge rectifier has a purely resistive load of *R*. Determine (a) the efficiency, (b) the FF, (c) the RF, (d) the TUF, (e) the peak inverse (or reverse) voltage (PIV) of each diode, and (f) the peak current through a diode. The rectifier delivers I_{dc} = 60 A at an output voltage of *V*dc = 280.7 V and the source frequency is 60 Hz.	*CO4*	*PO3*	**07**
	c)		Consider a single-phase full-wave rectifier with L = 6.5 mH, R = 2.5 Ω, and E = 10 V. The input voltage is Vs = 120 V at 60 Hz. Determine (i) the steady-state load current I_0 at ωt = 0, (ii) the average diode current $I_{D(av)}$, (iii) the rms diode current ID(rms), (iv) the rms output current Io(rms), and (v) the input power factor PF.	*CO4*	*PO3*	**06**
			UNIT - II			
3	a)		What are power MOSFETs? With a neat structure, symbol explain the working of n-channel depletion type power MOSFET?	*CO1*	*PO2*	**08**
	b)		Explain why Isolation of gate drive circuits is required in case of MOSFETs ?	*CO2*	*PO1, 2*	**07**

		c)	Give the comparison between Power MOSFET and IGBT?	*CO1*	*PO2*	**05**
			OR			
	4	a)	Explain the structure and working of IGBT?	*CO1*	*PO2*	**08**
		b)	Explain the structure and working of SiC MOSFET?	*CO1*	*PO2*	**07**
		c)	Explain the steady state characteristics of Enhancement type MOSFET?	*CO2*	*PO1, 2*	**05**
			UNIT - III			
	5	a)	With a neat diagram explain the working principle and V-I characteristics of SCR?	*CO2*	*PO1, PO2*	**10**
		b)	A three-phase full-wave converter is operated from a three-phase Y-connected 208-V, 60-Hz supply and the load resistance is R = 10 Ω. If it is required to obtain an average output voltage of 50% of the maximum possible output voltage, calculate (i) the delay angle α, (ii) the rms and average output currents, (iii) the average and rms thyristor currents, (iv) the rectification efficiency, (v) the TUF, and (vi) the input PF.	*CO4*	*PO3*	**10**
			OR			
	6	a)	With a neat diagram and waveform explain the operation of single-phase full converter with RL load in continuous conduction mode?	*CO3*	*PO2*	**10**
		b)	The full converter is connected to a 120-V, 60-Hz supply. The load current I is continuous and its ripple content is negligible. The turns ratio of the transformer is unity. (i) Express the input current in a Fourier series; determine the HF of the input current, DF, and input PF. (ii) If the delay angle is $\alpha = \pi/3$, calculate Vdc, Vn, Vrms, HF, DF, and PF.	*CO4*	*PO3*	**10**
			UNIT - IV			
	7	a)	With a neat diagram and waveform explain the working of step down DC-DC converter with RL load	*CO3*	*PO2*	**08**
		b)	Write the difference between DC-AC and DC-DC converter	*CO3*	*PO2*	**04**
		c)	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, Vc; (iii) the peak-to-peak ripple current of inductor, I; (iv) the peak current of the transistor, Ip; and (v) the critical values of L and C.	*CO4*	*PO3*	**08**

			OR			
	8	a)	Draw the circuit diagram of ZVS resonant converter with its equivalent circuits, capacitor voltage and Inductor current waveform	*CO3*	*PO2*	**08**
		b)	Explain the working of a Buck-boost converter?	*CO3*	*PO2*	**05**
		c)	With a neat diagram and waveform explain the Fly-back converter?	*CO3*	*PO2*	**07**
			UNIT - V			
	9	a)	With circuit diagram explain the operation of single-phase full bridge inverter supplying the R-load.	*CO3*	*PO2*	**10**
		b)	Explain the working of transistorized current source inverter?	*CO3*	*PO4, 5,9*	**10**
			OR			
	10	a)	With a neat circuit diagram and waveform explain 180° mode of operation of a three-phase inverter. Give the expression for line and phase voltages for one cycle.	*CO3*	*PO2*	**10**
		b)	What is Multilevel Inverter? Explain two types of Multilevel inverters?	*CO3*	*PO2*	**10**

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