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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: VI**
Branch: Electrical and Electronics Engineering **Duration: 3 hrs.**
Course Code: 22EE6PCPE2 **Max Marks: 100**
Course: Power Electronics - 2

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)	Express the supply current $\mathbf{i_S(t)}$ of a single-phase full converter using SCRs by Fourier series. Given $\mathbf{i_s = I_a}$ from $\boldsymbol{\alpha}$ **to** $\boldsymbol{(\pi + \alpha)}$ and $\mathbf{i_S = -I_a}$ from $\boldsymbol{(\pi + \alpha)}$ **to** $\boldsymbol{(2\pi + \alpha)}$ where α is the delay angle. Hence show that RMS value of fundamental current is $\mathbf{0.9I_a}$.	*CO2*	*PO1, PO2*	**10**
	b)	A three phase fully controlled converter is operated from a three-phase star connected 200V, 50Hz supply. The load resistance is R_L =10 Ω. Calculate i) Maximum possible output voltage. ii) Delay angle **α** to obtain **50%** of maximum possible output voltage. iii) Average load current with the delay angle as in (ii). iv) RMS value of the output voltage for the same delay angle	*CO2*	*PO1, PO2*	**10**
		OR			
2	a)	List and define the performance parameters of a single-phase bridge-controlled rectifier	CO2	PO1, PO2	**10**
	b)	A three-phase full converter charges a battery from a three-phase supply of 230 V, 50 Hz. The battery EMF is 200 V and its internal resistance is 0.5 ohm. The charging current is constant at 20 A. Compute the firing angle delay and input supply power factor.	CO2	PO1, PO2	**10**
		UNIT - II			
3	a)	Illustrate the principle of operation of a step-down converter. Show the effect of duty cycle (k) on the effective resistance seen by the source.	*CO1*	*PO2*	**08**
	b)	A DC-DC boost regulator has Vs= 5V, Va=15V and average current through the load is 0.5A. Given inductor ripple current is 0.9A and capacitor voltage ripple is 60mV compute the values of L and C of the converter. Draw the circuit and insert the values on it. Given switching frequency is 10kHZ.	*CO2*	*PO1, PO2*	**08**

		c)	Explain generation of gating signal (duty cycle) for DC-DC converter with the help of waveforms.	*CO3*	*PO2*	**04**
			OR			
	4	a)	Draw the circuit of a DC-DC buck regulator. Explain its operation with the help of waveforms?	*CO3*	*PO2*	**10**
		b)	A buck-boost regulator has an input voltage of Vs=12V, Duty cycle k= 0.25, switching frequency f_s=25kHz with an average load current of 1.25A. Given L= 150 µH and C = 220 µF calculate i) the average output voltage ii) the peak to peak output voltage ripple iii) the peak-peak ripple current of the inductor iv) the peak current of the transistor.	*CO2*	*PO1, PO2*	**10**
			UNIT - III			
	5	a)	Define the following parameters of inverters: i) Total Harmonic distortion ii) Distortion Factor iii) Harmonic Factor iv) Lowest order Harmonic	*CO2*	*PO1, PO2*	**10**
		b)	Draw the circuit diagram of a three-phase full bridge inverter using IGBT with DC supply voltage Vs. Give the switches state table along with the values of line-to-line voltages for each state.	*CO3*	*PO2*	**10**
			OR			
	6	a)	Show that RMS value of fundamental output voltage of a single-phase full bridge inverter is $0.9V_S$ where V_S is the DC supply voltage.	*CO2*	*PO1, PO2*	**10**
		b)	Draw the circuit diagram of a three-phase bridge inverter using MOSFET switches. Sketch the gating signal for each switch for 180-degree conduction mode and draw the line-to-line voltage waveforms. Take supply DC voltage as Vs.	*CO3*	*PO2*	**10**
			UNIT - IV			
	7	a)	What are the limitations of resonant converters? List the applications of DC-DC resonant converters.	*CO4*	*PO3*	**05**
		b)	What are the advantages of multilevel inverters? Explain the basic concept of multilevel inverters.	*CO1*	*PO2*	**05**
		c)	Explain the working of DC-DC M-type ZCS resonant converter with circuit diagram and waveforms	*CO4*	*PO3*	**10**
			OR			
	8	a)	Describe the operation of a ZVS resonant converter with the help of neat circuit diagram and wave forms in all the modes of its operation.	*CO4*	*PO3*	**10**
		b)	Explain the concept of multilevel inverters and mention their applications	*CO4*	*PO3*	**06**
		c)	What are the types of resonant tank circuits?	*CO4*	*PO3*	**04**

			UNIT - V			
	9	a)	Explain the working of a single-phase full converter fed separately excited DC motor drive.	*CO1*	*PO2*	**10**
		b)	Explain the concept behind Thyristor switched Reactor (TCR) and Thyristor Switched Capacitor (TCS). Mention their applications.	*CO1*	*PO2*	**10**
			OR			
	10	a)	With the help of a neat block diagram explain the operation of Uninterruptable power supply.	*CO1*	*PO2*	**10**
		b)	With the help of a neat circuit diagram explain the working of a fly back converter.	*CO1*	*PO2*	**10**

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