



SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

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Puttur -517583, Chittoor District, A.P. (India)

QUESTION BANK (DESCRIPTIVE)

Subject with Code: POWER ELECTRONICS (23EE0218)

Course & Branch: B.Tech - EEE

Year & Sem: III-B.Tech & I-Sem

Regulation: R23

UNIT –I **POWER SWITCHING DEVICES**

1	a	What is meant by forward recovery time and reverse recovery time in a power diode?	[L1][CO1]	[2M]
	b	Define latching current and holding current of a SCR.	[L2][CO1]	[2M]
	c	Why is a firing circuit required for triggering a thyristor?	[L2][CO1]	[2M]
	d	Distinguish between MOSFET and IGBT with respect to switching speed, conduction losses, and applications.	[L4][CO1]	[2M]
	e	Mention any two advantages of SiC semiconductor devices compared with Si semiconductor devices.	[L1][CO1]	[2M]
2		Obtain and illustrate the V–I characteristics of a power diode. Explain the characteristics with suitable voltage and current waveforms.	[L3][CO1]	[10M]
3		Sketch the V–I characteristics of an SCR and describe the operation of the device in forward blocking, forward conduction, and reverse blocking modes..	[L2][CO1]	[10M]
4		Explain about Transfer characteristics and output characteristics of MOSFET with waveforms.	[L2][CO1]	[10M]
5		Illustrate the switching characteristics of an IGBT and describe its turn-on and turn-off processes with appropriate waveforms.	[L3][CO1]	[10M]
6		With suitable circuit diagrams, describe the R-triggering and RC-triggering techniques used for firing an SCR.	[L3][CO1]	[10M]
7		With a neat circuit diagram and waveforms, describe the principle and operation of current commutation of an SCR..	[L3][CO1]	[10M]
8		Explain the voltage commutation of a thyristor with circuit and waveform.	[L2][CO1]	[10M]
9	a	Design and explain a suitable gate-drive circuit for a power MOSFET with a neat circuit diagram.	[L3][CO1]	[5M]
	b	List few applications of Power Switching Devices.	[L2][CO1]	[5M]
10	a	Compare GaN and SiC devices for power converter applications.	[L2][CO1]	[5M]
	b	Write some advantages and disadvantages of Power Switching Devices	[L2][CO1]	[5M]

UNIT –II
RECTIFIERS

1	a	Define rectifier and list two applications.	[L1][CO2]	[2M]
	b	State the expression for the average output voltage of a single-phase half-wave rectifier.	[L1][CO2]	[2M]
	c	Differentiate between controlled and uncontrolled rectifiers.	[L1][CO2]	[2M]
	d	What is meant by source inductance effect in a rectifier?	[L1][CO2]	[2M]
	e	Mention any two applications of dual converters.	[L1][CO2]	[2M]
2		Illustrate the operation of single phase half wave converter with R-Load at $\alpha=60^\circ$ with necessary wave forms. Also derive the average and RMS load voltage.	[L4][CO2]	[10M]
3		Analyze the operation of a single-phase full-wave controlled rectifier with an R–L load under continuous conduction mode. Draw the circuit and relevant waveforms and derive the average and RMS load voltage.	[L4][CO2]	[10M]
4		With neat circuit, explain a single-phase full-bridge thyristor rectifier with Resistive load.	[L3][CO2]	[10M]
5		A single Phase fully controlled converter supplies an inductive load. Assuming load current is constant=10A.Determine the following quantities if supply voltage is 230V, 50 Hz and $\alpha=40$. Calculate the i) Average Output Voltage of converter, ii) Supply RMS Current, iii) Supply Fundamental RMS Current, iv) Fundamental Power factor, v) Supply Power Factor, vi) Supply harmonic factor.	[L3][CO2]	[10M]
6		Analyze the operation of a single-phase full-bridge thyristor converter feeding an R–L load under discontinuous conduction for $\alpha = 90^\circ$. Draw the circuit and waveforms and derive the average and RMS load voltage.	[L4][CO2]	[10M]
7		Evaluate the performance of dual converters for four-quadrant operation with Output Voltage Waveforms.	[L4][CO2]	[10M]
8		Illustrate the operation of Three phase fully controlled rectifier with R- load at $\alpha=30^\circ$ and also derive the average output Voltage	[L4][CO2]	[10M]
9		Explain the operation of Three phase fully controlled rectifier with R-L load at $\alpha=90^\circ$ and also derive the average Output Voltage.	[L2][CO2]	[10M]
10	a	State and explain the major applications of phase-controlled converters in power electronic systems.	[L2][CO2]	[5M]
	b	Compare half-controlled and fully controlled converters in terms of circuit configuration, output voltage control, operating modes, power flow, and applications.	[L4][CO2]	[5M]

UNIT –III**DC-DC CONVERTERS**

1	a	Define duty ratio in a DC–DC converter.	[L1][CO3]	[2M]
	b	Write the average output voltage equation of a buck converter.	[L1][CO3]	[2M]
	c	Differentiate between buck and boost converters.	[L1][CO3]	[2M]
	d	Mention two applications of buck–boost converters.	[L1][CO3]	[2M]
	e	List any two control strategies in choppers.	[L1][CO3]	[2M]
2		A DC chopper is connect to a 100V DC source supplies an inductive load having 40 mh in series with a resistance of 5ohms. A freewheeling diode is placed across the load. The load current varies between the limits of 10A and 12A. Determine the time ratio of the chopper.	[L3][CO3]	[10M]
3		Explain duty ratio control strategies with neat waveforms.	[L2][CO3]	[10M]
4		With a neat circuit diagram, explain the operation of a buck converter and derive the expression for its average output voltage.	[L3][CO3]	[10M]
5		For step down chopper dc source voltage is 230v, load resistance is 10 ohm. Thechopper when it is in ON is 2V. For a duty cycle of 0.4. Calculate a) average and rms values of output voltage b) chopper efficiency.	[L3][CO3]	[10M]
6	a	List some applications of dc chopper?	[L1][CO3]	[2M]
	b	A DC Chopper (Step-Down) has a resistive load $R=10\Omega$ and the input voltage=200v. When the chopper remains on, its voltage drop is 2V. The chopper frequency is 1Khz. If the duty cycle is 50% Determine i) Average Output Voltage, ii) RMS Output Voltage, iii) Chopper Efficiency & iv) Effective input resistance of chopper	[L3][CO3]	[8M]
7		The buck converter has an input voltage of $E_{dc}=12V$. the required average output voltage is $E_0=5V$ at $R=500\Omega$ and the peak-to-peak output voltage is 20mV, the switching frequency is 2kHz. if the peak-to-peak ripple current of inductor is limited to 0.8A, determine (a) the duty cycle (b) the filter inductance L and (c) the filter capacitor C, and (d) the critical values of L and C.	[L3][CO3]	[10M]
8		Illustrate the Mode of operation of a buck–boost converter.	[L4][CO3]	[10M]
9		With average voltage & current, explain the working principle of a boost converter.	[L2][CO3]	[10M]
10		The boost converter has an input voltage of $E_{dc}=5V$. the required average output volta e is $E_0=15V$ and the average load current $I_0=0.5A$. The switching frequency is 25 kHz. If the $L=150\mu H$ and $C=220\mu F$, Determine (a) the duty cycle (b) the ripple current of inductor ΔI (c) the peak current of inductor I_2 , (d) The ripple voltage of filter capacitor ΔV_C , and (e) the critical values of L and C	[L3][CO3]	[10M]

UNIT –IV
INVERTERS

1	a	Define inverter and its applications.	[L1][CO4]	[2M]
	b	List the types of PWM techniques used in inverters.	[L1][CO4]	[2M]
	c	Differentiate between 180° and 120° modes of VSI.	[L2][CO4]	[2M]
	d	State the principle of operation of a parallel inverter.	[L1][CO4]	[2M]
	e	Mention two applications of current source inverters.	[L1][CO4]	[2M]
2		Analyze the operation of a single-phase Voltage Source Inverter (VSI) feeding an R-load	[L4][CO4]	[10M]
3	a	Explain briefly about forced commutated inverters.	[L2][CO4]	[5M]
	b	A single-phase full-bridge inverter is fed from a dc source such that Fundamental component of output voltage is 230 V. Find the rms value of thyristor and diode currents for the load $R = 20\Omega$	[L3][CO4]	[5M]
4	a	With diagram, explain PWM techniques used in inverters.	[L2][CO4]	[5M]
	b	A single-phase bridge inverter delivers power to a series connected RLC load have $R = 20\Omega$ and $\omega L = 10\Omega$. The periodic time $T = 0.1$ msec. What value of C should the load in order to obtain load commutation for the SCRs. The thyristor turn off time is $10\mu\text{sec}$. Take circuit turn off time as $1.5T_q$. Assume that load current contains only fundamental component.	[L3][CO4]	[5M]
5		Explain the operation of a single-phase current source inverter with ideal switches.	[L2][CO4]	[10M]
6		Illustrate the operation of a three-phase Voltage Source Inverter (VSI) operating in 180° conduction mode. With neat circuit diagram, voltage and current waveforms, describe the sequence of switching and output phase voltage	[L4][CO4]	[10M]
7		Explain the principle of operation of a single-phase parallel inverter.	[L2][CO4]	[10M]
8		Illustrate the principle of a single-phase series inverter with necessary diagrams.	[L4][CO4]	[10M]
9		Illustrate the operation of a three-phase Voltage Source Inverter (VSI) operating in 120° conduction mode. With neat circuit diagram, voltage and current waveforms, describe the sequence of switching and output phase voltage	[L4][CO4]	[10M]
10		A three-phase bridge inverter delivers power to a resistive load from a 450 V dc source. For a star-connected load of 10 ohm per phase, determine for both (a) 180° mode and (b) 120° mode, (i) rms value of load current (ii) rms value of thyristor current (iii) load power.	[L3][CO4]	[10M]

UNIT –V**AC VOLTAGE CONTROLLERS AND CYCLO-CONVERTER**

1	a	Define phase control in AC voltage controllers.	[L1][CO5]	[2M]
	b	Derive the RMS load voltage expression for a single-phase AC voltage controller with R load.	[L2][CO5]	[2M]
	c	What is meant by phase control?	[L1][CO6]	[2M]
	d	Define the integral cycle control.	[L1][CO6]	[2M]
	e	Mention two applications of cyclo-converters.	[L1][CO5]	[2M]
2		Explain the Mode of operation of single-phase AC voltage controller with R-L load and derive the RMS Output Voltage.	[L2][CO5]	[10M]
3		The single phase full wave AC voltage controller has a resistive load of $R=5\Omega$ & the input voltage $V_S=120V(RMS), 50HZ$. The delay angles of thyristors T1 & T2 are equal i.e., $\alpha_1=\alpha_2=2\pi/3$. Determine (a) The RMS output voltage (b) Input power factor (c) Average current of thyristor (d) The RMS current of thyristor.	[L3][CO5]	[10M]
4		Analyze the Mode of Operation of TRIAC with R Load.	[L4][CO6]	[10M]
5		Explain the Mode of Operation of TRIAC with R-L Load.	[L2][CO6]	[10M]
6		Illustrate the principle of operation of single phase to single phase step-up midpoint cycloconverter with Resistive Load	[L4][CO5]	[10M]
7		Explain the principle of operation of single phase to single phase step-down midpoint type cycloconverter with Resistive Load	[L2][CO5]	[10M]
8		Illustrate the principle of operation of single phase to single phase Bridge type step-down cycloconverter with Resistive Load	[L4][CO5]	[10M]
9		Explain the principle of operation of single phase to single phase step-down Bridge type cycloconverter with Resistive Inductive Load for Continuous Load Current.	[L2][CO5]	[10M]
10		Illustrate the principle of operation of single phase to single phase step-down midpoint type cycloconverter with Resistive Inductive Load for Discontinuous Load Current.	[L4][CO5]	[10M]

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