Course Code: 23EE0218 **R23**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)
(Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu)
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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**	Describe the forward recovery and reverse recovery times of a diode.	**[L1][CO1]**	**[2M]**
	b	Define latching current and holding current of a thyristor.	**[L1][CO1]**	**[2M]**
	c	State the need for firing circuits in thyristors.	**[L1][CO1]**	**[2M]**
	d	Differentiate between MOSFET and IGBT.	**[L1][CO1]**	**[2M]**
	e	List two advantages of SiC devices over Si devices.	**[L1][CO1]**	**[2M]**
2		Draw and explain the I–V characteristics of a diode along with waveform.	**[L2][CO1]**	**[10M]**
3		Draw and explain the I–V characteristics of a thyristor with neat diagram.	**[L2][CO1]**	**[10M]**
4		Explain about Transfer characteristics and output characteristics of MOSFET with waveforms.	**[L2][CO1]**	**[10M]**
5		Explain the Switching characteristics of a IGBT with neat diagram.	**[L2][CO1]**	**[10M]**
6		With circuit, explain the firing circuit of a thyristor using R and RC triggering.	**[L2][CO1]**	**[10M]**
7		Draw and explain current commutation of a Thyristor.	**[L2][CO1]**	**[10M]**
8		Explain the voltage commutation of a thyristor with circuit and waveform.	**[L2][CO1]**	**[10M]**
9	**a**	With circuit diagram, explain a Gate drive circuit for MOSFET.	**[L2][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]**

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UNIT –II
RECTIFIERS

1	**a**	Define rectifier and list two applications.	**[L1][CO2]**	**[2M]**
	b	Write the expression for average DC output voltage of a half-wave rectifier.	**[L1][CO2]**	**[2M]**
	c	Differentiate between controlled and uncontrolled rectifiers.	**[L1][CO2]**	**[2M]**
	d	Define the effect of source inductance in rectifiers.	**[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 α=60° with necessary wave forms. Also derive the average and RMS load voltage.	**[L4][CO2]**	**[10M]**
3		With circuit and waveforms, explain a single-phase full-wave rectifier with RL load for Continuous Conduction Mode also derive the average and RMS load voltage.	**[L2][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 α=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		With circuit and waveforms, Explain a Single-Phase Full Bridge Thyristor rectifier with RL loads for Discontinuous Conduction Mode also derives the average and RMS load voltage. α=90°	**[L2][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 α=30° and also derive the average output Voltage	**[L4][CO2]**	**[10M]**
9		Illustrate the operation of Three phase fully controlled rectifier with R-L load at α=90° and also derive the average Output Voltage.	**[L4][CO2]**	**[10M]**
10	**a**	List the different applications of phase-controlled converters.	**[L2][CO2]**	**[5M]**
	b	Differentiate the half-controlled converter and fully controlled converter.	**[L2][CO2]**	**[5M]**

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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 diagram and derivation, explain the working of a buck converter.	**[L2][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=10Ω 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 Edc=12V.the required average output voltage is E0=5V at R=500Ω 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 Edc=5V.the required average output volta e is E0=15V and the average load current I0=0.5A. The switching frequency is 25 kHz. If the L=150µH and C=220µF, Determine (a) the duty cycle (b) the ripple current of inductor ΔI (c) the peak current of inductor I2, (d) The ripple voltage of filter capacitor ΔVC, and (e)the critical values of Land C	**[L3][CO3]**	**[10M]**

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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		Explain the operation of a single-phase VSI with R-load.	**[L2][CO4]**	**[10M]**
3	**a**	Explain briefly about forced commutated inverters.	**[L2][CO4]**	**[5M]**
	b	A single-phase full-bridge inverter in 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 = 20ohm	**[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 = 2ohm and ωL = 10ohm. 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 10μsec. Take circuit turn off time as 1.5Tq. 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		Illustrate the principle of operation of a single-phase parallel inverter.	**[L4][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]**

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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	Define the 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=5Ω & the input voltage VS=120V(RMS),50HZ. The delay angles of thyristors T1 &T2 are equal i.e., $\alpha1=\alpha2=2\pi/3$. 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		Explain the Mode of Operation of TRIAC with R Load.	**[L2][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		Illustrate the principle of operation of single phase to single phase step-down midpoint type cycloconverter with Resistive Load	**[L4][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		Illustrate the principle of operation of single phase to single phase step-down Bridge type cycloconverter with Resistive Inductive Load for Continuous Load Current.	**[L4][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]**

PREPARED BY

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