



SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

(Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu)

(Accredited by NBA for Civil, EEE, Mech., ECE & CSE)

Accredited by NAAC with 'A' Grade)

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

QUESTION BANK (DESCRIPTIVE)

Subject with Code: POWER ELECTRONICS (20EE0209)

Course & Branch: B.Tech - EEE

Year & Sem: II-B.Tech & II-Sem

Regulation: R20

UNIT –I SWITCHING DEVICES

1	Classify the types of Power Semiconductor Devices and Mention Advantages, Applications of Power Semi-Conductor Devices?	[L4][CO1]	[12M]
2	Draw and explain V-I Characteristics of Power Diode?	[L2][CO1]	[12M]
3.	Draw and explain V-I characteristics of SCR and Its working.	[L2][CO1]	[12M]
4.	Describe about Insulated Gate Bipolar Transistor (IGBT) and it's switching characteristics.	[L2][CO1]	[12M]
5.	Explain the Resistance firing circuit with the necessary waveforms.	[L2][CO1]	[12M]
6	Describe about Metal Oxide Semiconductor Field Effect Transistor (MOSFET) and it's switching characteristics.	[L2][CO1]	[12M]
7	Illustrate the voltage commutation and draw the output wave forms.	[L4][CO1]	[12M]
8	Explain the Resistance Capacitance firing circuit with the necessary waveforms.	[L2][CO1]	[12M]
9	Illustrate the Current commutation and draw the output wave forms.	[L4][CO1]	[12M]
10	Describe the different types of Thyristor Turn-on Methods	[L2][CO1]	[12M]

UNIT –II
RECTIFIERS

1		Describe the operation of single-phase half wave converter with R-Load at $\alpha=60$ with necessary wave forms. Also derive the output voltage, output current and RMS output voltages.	[L2][CO2]	[12M]
2		The single-Phase half wave Controlled converter has a purely resistive load of $R=10\Omega$ & the delay angle is $\alpha=60$, if supply voltage is 230V, 50 Hz. Determine (a) Rectification efficiency (b) Form factor (c) Ripple factor (d) Transformer utilization factor (e) Peak inverse voltage for SCR T1	[L3][CO2]	[12M]
3		Describe the operation of single-phase half wave converter with RL-Load at $\alpha=30$ with necessary wave forms. Also derive the output voltage, output current and RMS output voltages.	[L2][CO2]	[12M]
4		The single-Phase half Controlled converter is connected to 230V Ac Supply. The Load Current can be assumed continuous and ripple free. If delay angle is $\alpha=90$. Calculate the Average Output Voltage, V_{dc} & RMS Output Voltage V_{rms} .	[L3][CO2]	[12M]
5		Describe the operation of single-phase Full wave converter with R-Load at $\alpha=45$ with necessary wave forms. Also derive the output voltage, output current and RMS output voltages.	[L2][CO2]	[12M]
6		Describe the operation of single-phase Full wave converter with RL-Load at $\alpha=30$ with necessary wave forms. Also derive the output voltage, output current and RMS output voltages.	[L2][CO2]	[12M]
7		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]	[12M]
8	a	List the different applications of phase-controlled converters.	[L1][CO2]	[6M]
	b	Differentiate the half-controlled converter and fully controlled converter.	[L2][CO2]	[6M]
9		Illustrate the operation of Three phase fully controlled rectifier with R- load at $\alpha=60$ and also derive the average and RMS load voltage.	[L4][CO2]	[12M]
10		Illustrate the operation of Three phase fully controlled rectifier with RL- load at $\alpha=30$ and also derive the average and RMS load voltage.	[L4][CO2]	[12M]

UNIT –III
CHOPPER

1		Define a DC chopper? Describe various types of chopper configurations. With appropriate diagram wherever necessary.	[L1][CO3]	[12M]
2		Describe the step-down chopper with neat diagrams	[L2][CO3]	[12M]
3		A DC Chopper (Step-Down) has a resistive load $R=10\Omega$ and the input voltage $=200\text{V}$. 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]	[12M]
4	a	For step down chopper dc source voltage is 230v, load resistance is 10 ohm. The chopper 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]	[8M]
	b	List some applications of dc chopper?	[L1][CO3]	[4M]
5		A Step-up Chopper has input voltage of 220V and output voltage of 660v. If non-conduction time of thyristor is $100\mu\text{sec}$. Determine on time of chopper. If on-time is halved for constant frequency operation, find the new output voltage.	[L3][CO3]	[12M]
6		Illustrate the buck converter operation with help of diagram and also draw the output waveform	[L4][CO3]	[12M]
7		The buck converter has an input voltage of $E_{dc}=12\text{V}$. the required average output voltage is $E_0=5\text{V}$ 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]	[12M]
8		Illustrate the boost converter operation with help of diagram and also draw the output waveforms.	[L4][CO3]	[12M]
9		The boost converter has an input voltage of $E_{dc}=5\text{V}$. the required average output voltage is $E_0=15\text{V}$ and the average load current $I_0=0.5\text{A}$. The switching frequency is 25 kHz. If the $L=150\mu\text{H}$ and $C=220\mu\text{F}$, 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]	[12M]
10		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]	[12M]

UNIT –IV
CYCLOCONVERTER

1	Describe the principle of operation of single phase to single phase step-up midpoint cycloconverter with Resistive Load	[L2][CO4]	[12M]
2	Describe the principle of operation of single phase to single phase Bridge type step-up cycloconverter with Resistive Load	[L2][CO4]	[12M]
3	Describe the principle of operation of single phase to single phase step- down midpoint type cycloconverter with Resistive Load	[L2][CO4]	[12M]
4	Describe the principle of operation of single phase to single phase Bridge type step-down cycloconverter with Resistive Load	[L2][CO4]	[12M]
5	Illustrate the principle of operation of single phase to single phase step- down midpoint type cycloconverter with Resistive Inductive Load for Continuous Load Current.	[L4][CO4]	[12M]
6	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][CO4]	[12M]
7	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][CO4]	[12M]
8	Illustrate the principle of operation of single phase to single phase step- down Bridge type cycloconverter with Resistive Inductive Load for Discontinuous Load Current.	[L4][CO4]	[12M]
9	The Input Voltage to the Bridge type Cycloconverter is 230v, 50 Hz Single-Phase. The Load resistance is 10Ω and the load inductance is 60mH. The frequency of the output is 25Hz. If the Converters are operated as semi converters such that $0 < \alpha < \pi$ and the delay angle $\alpha = 2\pi/3$, Determine a) The RMS Value of Output voltage, b) The RMS Current of each thyristor and C) The input Power Factor (PF).	[L3][CO4]	[12M]
10	The input voltage of the cycloconverter is 120V(rms). The load resistance is 5Ω and the inductance is $L=40\text{ mH}$. The frequency of the output voltage is 25Hz. If the converters are operated as semi converters that $0 \leq \alpha \leq \pi$. The delay angle is $\alpha_p = 2\pi/3$, determine(a) The rms value of output voltage V_0 (b) The rms value of output current I_0 (c) The input power factor	[L3][CO4]	[12M]

UNIT –V
AC VOLTAGE CONTROLLERS

1	a	Define ac voltage controllers and what are the different types?	[L1][CO5]	[6M]
	b	List the applications of ac voltage controller.	[L1][CO5]	[6M]
2		Describe about the single-phase half wave ac voltage controller with resistive load.	[L2][CO5]	[12M]
3		Describe the operation of single-phase full wave ac voltage controller with resistive load.	[L2][CO5]	[12M]
4		Illustrate the operation of single phase full wave ac voltage controller with R-L load.	[L4][CO5]	[12M]
5		A single phase voltage controller is employed for controlling the power flow from 230V, 50Hz source into a load circuit consisting of $R=3\ \Omega$ and $L=4\ \Omega$. Calculate (i) the range of firing angle (ii) the maximum value of rms load current (iii) the maximum power and power factor (iv) The maximum values of average and rms thyristor currents	[L3][CO5]	[12M]
6	a	Outline the applications of AC voltage controller?	[L4][CO6]	[6M]
	b	Outline the advantages and disadvantages of AC voltage controller?	[L4][CO6]	[6M]
7		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 T_1 & T_2 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][CO6]	[12M]
8		Describe the operation of TRIAC in different modes.	[L2][CO6]	[12M]
9		Illustrate the operation of TRIAC with R and RL load.	[L4][CO6]	[12M]
10	a	A 230V, 1KW electric heater is fed through an AC voltage regulator from 230V, 50HZ source. Find the load power for a firing angle delay.	[L3][CO6]	[6M]
	b	A single-phase static switch operates between a supply of 230V, 50HZ & a load of power 8KW & power factor=0.75 lagging. Find (a) The peak inverse voltage (b) The peak current of thyristor (c) The average current of thyristor (d) The RMS current of thyristor.	[L3][CO6]	[6M]

Prepared by:
Dr. J.Gowrishankar
Professor/EEE