SRM VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

B.E

QUESTION BANK

VI SEMESTER

1905606– MODERN POWER CONVERTERS

Regulation – 2019

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DEPARTMENT OF EEE

QUESTION BANK

SUBJECT : 1905606 – Modern Power Converters

SEM / YEAR: VI / 2024-25 (Even)

UNIT I SWITCHED MODE POWER SUPPLIES (SMPS)				
DC Power supplies and Classification; Switched mode dc power supplies - with and without isolation, single and multiple outputs; Closed loop control and regulation; Design examples on converter and closed loop performance.				
PART – A				
Q.No	**Questions**	**BTL Level**	**Domain**	**COs**
1.	Differentiate between linear and switching mode DC power supplies.	BTL-2	Understand	CO1
2.	What are the types of SMPS?	BTL-1	Remember	CO1
3.	Mention the advantages of SMPS.	BTL-1	Remember	CO1
4.	List the advantages of isolated vs. non-isolated DC-DC converters.	BTL-6	Create	CO1
5.	List out the difference between fly back and push pull topologies.	BTL-5	Evaluate	CO1
6.	Obtain the input-output voltage and current relation as a function of duty ratio for a Buck-Boost dc-dc converter in continuous conduction mode.	BTL-3	Apply	CO1
7.	What is a switching mode regulator?	BTL-1	Remember	CO1
8.	How Dc power supplies are classified?	BTL-6	Create	CO1
9.	Classify the types of isolated SMPS.	BTL-2	Understand	CO1
10.	List the types of non-isolated SMPS.	BTL-2	Understand	CO1
11.	What are the necessary requirements for a power supply to be used in Industrial applications?	BTL-1	Remember	CO1
12.	What are the performance parameters of a converter?	BTL-5	Evaluate	CO1
13.	What is multioutput boost converter?	BTL-1	Remember	CO1
14.	Which type of isolated converters will be used for low voltage and high voltage applications?	BTL-2	Understand	CO1
15.	Draw the block diagram of closed loop control of converters.	BTL-4	Analyse	CO1
16.	What are the four basic types of switching mode regulators.?	BTL-3	Apply	CO1
17.	Write the expression for the output voltage of half bridge converter.	BTL-3	Apply	CO1

18.	Define duty cycle.	BTL-4	Analyse	CO1
19.	Write the expression for the output voltage of buck and boost converter.	BTL-4	Analyse	CO1
20.	With a help of block diagram explain the basic principle of operation of SMPS	BTL-1	Remember	CO1
21	Define closed loop control.	BTL-5	Evaluate	CO1
22	How closed loop control affect the performance of SMPS?	BTL-1	Remember	CO1
23	List out the difference between isolated and non-isolated SMPS.	BTL-2	Understand	CO1
24	Write the expression for the output voltage of boost converter.	BTL-1	Remember	CO1
PART – B				
1.	i. What is SMPS? Give its operating principle and industrial applications. (6) ii. List the various types of SMPSs. Describe SMPS with a pushpull configuration. (7)	BTL-2	Understand	CO1
2.	Describe flyback SMPS with relevant equivalent circuits and waveforms. Derive the various. expressions for voltages and currents involved. (13)	BTL-2	Understand	CO1
3.	Describe SMPSs using half-bridge and full-bridge configurations. Enumerate the advantages and disadvantages possessed by SMPSs. (13)	BTL-1	Remember	CO1
4.	Discuss operation of Cuk converter. Derive the relation between duty ratio and input voltage. (13)	BTL-4	Analyse	CO1
5.	What is the difference between isolated and non-isolated dc power supply? Explain fly back converter topology with diagram and wave forms. (13)	BTL-1	Remember	CO1
6.	i. State important advantages, disadvantages and applications of SMPS. (3) ii. Discuss design criterion of SMPS. (4) iii. Discuss operation of Flyback converter. Draw its circuit diagram and waveforms. (6)	BTL-2	Understand	CO1
7.	i. Explain fly back converter topology with diagram and waveforms (7) ii. Compare buck, boost and buck-boost converter with reference to technical parameters. (6)	BTL-4	Analyse	CO1
8.	Illustrate the push pull converter with neat circuit diagram & waveform and derive the equation of output voltage in terms of input voltage & duty cycle. (13)	BTL-3	Apply	CO1
9.	i. Compare switching voltage regulator with linear voltage regulator. (3) ii. Explain half bridge converter. (4) iii. Discuss operation of Buck converter in continuous and discontinuous mode. (6)	BTL-1	Remember	CO1

10.	i. Explain boost switching regulators. (3) ii. Explain fly back converter. (4) iii. Discuss operation of Push pull converter type switched mode dc power supply along with necessary waveforms. (6)	BTL-1	Remember	CO1
11.	With neat circuit diagram & waveform explain the operation of a BOOST converter in CCM and Derive the equation of (1) Peak to Peak Inductor Current (2) Peak to Peak Capacitor Voltage (3) Critical value of inductor & Capacitor. (13)	BTL-6	Create	CO1
12.	Design and describe the analysis of buck boost converter. (13)	BTL-3	Apply	CO1
13.	Design a Buck-Boost converter circuit having parameters, input voltage =24 V, D=0.4, load resistance =5ohm, L=20 microH, C=80 microF. Determine the output voltage, average inductor current, Maximum and minimum value of inductor current and the output voltage ripple. Assume a switching frequency of 100 kHz. (13)	BTL-5	Evaluate	CO1
14.	Draw the circuit diagram and explain the operation of a full bridge converter and draw the load current and load voltage waveform. (13)	BTL-4	Analyze	CO1
15	Design and describe the analysis of buck converter. (13)	BTL-6	Create	CO1
16	With neat circuit diagram & waveform explain the operation of a Buck converter in CCM and Derive the equation of (1) Peak to Peak Inductor Current (2) Peak to Peak Capacitor Voltage (3) Critical value of inductor & Capacitor. (13)	BTL-3	Apply	CO1
17	With neat circuit diagram & waveform explain the operation of a cuk converter.	BTL-5	Evaluate	CO1
PART – C				
1	Design a Buck converter to produce an output voltage of 18 V across 10ohm load resistance. The output voltage ripple must not exceed 0.5 percent. The DC supply is 48 V. Design for continuous inductor current. Find out the duty ratio, the values of inductance and capacitor. (15)	BTL-5	Evaluate	CO1
2	Draw the circuit diagram and explain the operation of a full bridge converter and draw the load current and load voltage waveform. (15)	BTL-6	Create	CO1
3	The buck-boost regulator has an input voltage = 12 V, duty cycle = 0.25, switching frequency = 25 kHz, inductor = 150 μH, filter capacitor = 220 μF and average load current = 1.25 A. Determine (a) Average output voltage (b) Peak to peak output voltage ripple (c) Peak to peak ripple current (d) Peak current of switch (e) Critical value of L and C. (15)	BTL-6	Create	CO1

4	A flyback SMPS supplies. a load of 40A at 5V. The source voltage is 240V dc and the transformer initial magnetizing current is 0.4 A. The power MOSFET is operating at a frequency of 50 kHz with a duty cycle of 0.4. Determine the transformer turns ratio from primary to secondary and its inductance. Assume ideal components and no ripple in load voltage. Find also the open-circuit voltage across the semiconductor device. (15)	BTL-5	Evaluate	CO1
5	Illustrate the flyback converter with neat circuit diagram & waveform and derive the equation of output voltage in terms of input voltage & duty cycle.	BTL-5	Evaluate	CO1

UNIT II AC-DC CONVERTERS

Switched mode AC-DC converters. synchronous rectification - single and three phase topologies - switching techniques - high input power factor. reduced input current harmonic distortion. improved efficiency. with and without input-output isolation. performance indices design examples

PART – A

Q.No	Questions	BTL Level	Domain	COs
1.	Define synchronous rectification.	BTL-1	Remember	CO2
2.	List out the different types of controlled rectifier.	BTL-1	Remember	CO2
3.	Quote the expression for the RMS output voltage in single phase fully controlled rectifier with RLE load.	BTL-2	Understand	CO2
4.	Generalize the expression for the Average and RMS output voltage in single phase semi converter.	BTL-6	Create	CO2
5.	Evaluate the various applications of controlled converter.	BTL-5	Evaluate	CO2
6.	Name a key advantage of three-phase AC-DC converters over single-phase converters.	BTL-3	Apply	CO2
7.	List the two configuration of single phase two pulse-controlled rectifier.	BTL-2	Understand	CO2
8.	Define Harmonic Distortion.	BTL-6	Create	CO2
9.	Draw the output current waveform of single phase semi controlled AC-DC converter fed RL load for $\alpha = 30^{\circ}$.	BTL-1	Remember	CO2
10.	Give the power balance equation in converter circuits.	BTL-2	Understand	CO2
11.	Define ripple and distortion factor.	BTL-1	Remember	CO2
12.	What do you mean by Synchronous Rectification?	BTL-5	Evaluate	CO2
13.	Define voltage ripple factor.	BTL-1	Remember	CO2
14.	List the advantages of using a freewheeling diode in a semi converter circuit.	BTL-4	Analyse	CO2
15.	Differentiate the rectifier mode and inverter mode in single phase converters.	BTL-2	Understand	CO2
16.	Illustrate the effect of source inductance in single phase converters.	BTL-3	Apply	CO2
17.	Examine the conditions required for operating the full converter in the inverter mode.	BTL-3	Apply	CO2

18.	State reactive power.	BTL-4	Analyze	CO2
19.	Point out the power factor improvement techniques.	BTL-4	Analyze	CO2
20.	How input current harmonic distortion can be reduced in AC-DC converters?	BTL-1	Remember	CO2
21.	Define THD.	BTL-1	Remember	CO2
22.	Generalize the expression for the average and RMS output voltage in single phase full converter.	BTL-4	Analyse	CO2
23.	Define commutation.	BTL-2	Understand	CO2
24.	What is the effect of AC side inductance?	BTL-3	Apply	CO2
PART – B				
1.	Discuss on a single-phase full converter feeding RLE load. (13)	BTL-2	Understand	CO2
2.	Describe the principle of operation of a single-phase semi converter with freewheeling diodes. Sketch the circuit diagram and draw the waveforms for source voltage, output voltage, thyristor currents, diode currents, source current, load current and freewheeling diode current assuming a large inductor in the load. Derive the expression for average output voltage and also derive the expression for RMS output voltage. (13)	BTL-2	Understand	CO2
3.	Examine the principle of operation for a single-phase full converter with R-L load and no freewheeling diode. Sketch the circuit diagram and draw the waveforms for source voltage, output voltage, load current and source current assuming a large inductor and no ripple in the output current. Derive the expression for RMS output voltage. (13)	BTL-4	Remember	CO2
4.	Analyse the single-phase dual converter. (13)	BTL-4	Analyse	CO2
5.	Explain the operation of three phase 3 pulse converter with R load. Derive average output voltage. (13)	BTL-1	Remember	CO2
6.	Discuss the operation of single phase fully controlled rectifier supplying RL load with neat waveforms. Also derive the expression for the average output voltage.	BTL-2	Understand	CO2
7.	A 3-phase bridge converter is used for obtaining a regulated Dc output voltage. The supply voltage is 440V and the firing angle is maintained at 60˚ so that the load current is 15 A. Calculate (13) 1)DC output voltage 2)active and reactive power input 3)DC output voltage if freewheeling diode is connected 4) Derive the expression used.	BTL-4	Analyse	CO2
8.	Examine on a three-phase operation full controlled bridge converter. (13)	BTL-3	Apply	CO2
9.	Describe the three phase operation of semi-converter R and RL load. (13)	BTL-1	Remember	CO2

10.	A six pulse thyristor converter connected on the secondary of delta /star connected 6.6 kV /415V ,50 Hz transformer is supplying to 460 V,200 A DC load. Identify the following (i) converter firing angle (ii)dc power delivered by the converter (iii)AC line current (iv)RMS value of the device current. (13)	BTL-2	Understand	CO2
11.	Generalize the three-phase operation of semi-converter RLE load. (13)	BTL-6	Create	CO2
12.	Demonstrate the power factor improvement techniques and explain the reactive power. (13)	BTL-3	Apply	CO2
13.	Evaluate the inverter mode of operation for thyristor converters. (13)	BTL-5	Evaluate	CO2
14.	With relevant waveforms, derive the expression for average and rms value of output voltage in a single phase full controlled converter with RL load. (13)	BTL-4	Analyze	CO2
15.	Construct the full-wave phase-controlled rectifier with two SCRs, two diodes D1, D2, and a flyback diode D3. (13)	BTL-2	Understand	CO2
16.	Derive the power factor for the phase-controlled full-wave bridge rectifier under constant load current. (13)	BTL-2	Understand	CO2
17.	Derive the THD for the full-bridge phase-controlled rectifier. (13)	BTL-4	Remember	CO2
	PART – C			
1	The single-phase full converter has a RL load having L=6.5 mH, R= 0.5Ω and E=10V.The input voltage is V_s=120Vat (rms)60 Hz. Evaluate the following (a)the load current I_{LO} at ωt=α=60^o, (b)the average thyrsitor current I_A, (c)the rms thyristor current I_R, (d)the rms output current I_{rms}, (e)the average output I_{dc}, and (f)the critical delay angle α_c. (15)	BTL-5	Evaluate	CO2
2	The single-phase dual converter is operated from a 120V, 60 Hz supply and the load resistance is R=10Ω. The circulating inductance is L_r=40mH.delay angles are α_1=60^o and α_2=120^o.Design the peak circulating current and peak current of converter1. (15)	BTL-6	Create	CO2
3	Integrate the single-phase full converter feeding RLE load and PWM rectifiers. (15)	BTL-6	Create	CO2
4	Summarize the Three phase operation of semi-converter R and RL load and evaluate the power factor improvement techniques and explain the reactive power. (15)	BTL-5	Evaluate	CO2
5	Describe the three-phase operation of full converter R and RL load. (15)	BTL-5	Evaluate	CO2

UNIT III DC-AC CONVERTERS

Multi-level Inversion - concept, classification of multilevel inverters, Principle of operation, main features and analysis of Diode clamped, Flying capacitor and cascaded multilevel inverters; Modulation schemes.

PART - A

Q.No	Questions	BTL Level	Domain	COs
1.	Why higher levels are not possible with diode clamped multilevel inverters?	BTL-2	Understand	CO3
2.	Mention the applications of multi-level inverter.	BTL-1	Remember	CO3
3.	How many switching device and clamping diodes are present in m-level diode clamped inverters?	BTL-1	Remember	CO3
4.	Draw the circuit diagram of five level flying capacitor of single-phase inverter?	BTL-6	Create	CO3
5.	What are the features of a multilevel inverter?	BTL-5	Evaluate	CO3
6.	Compare diode clamped with flying capacitors multilevel inverter.	BTL-3	Apply	CO3
7.	What are the advantages of multilevel inverter?	BTL-1	Remember	CO3
8.	What are the conditions needed for the structure of multilevel inverter?	BTL-6	Create	CO3
9.	Give the classification of multilevel inverter?	BTL-2	Understand	CO3
10.	What are the devices required for an m-level inverter in Diode-Clamped Multilevel inverter?	BTL-2	Understand	CO3
11.	What are the rules governing the switching of an m-level inverter?	BTL-1	Remember	CO3
12.	Give the Different type of Multi level inverters.	BTL-5	Evaluate	CO3
13.	How selective harmonics elimination is achieved in multilevel inverters?	BTL-1	Remember	CO3
14.	What is the main disadvantage of diode clamped multilevel inverters?	BTL-4	Analyze	CO3
15.	List the merits and demerits of cascaded H bridge multilevel inverters.	BTL-2	Understand	CO3
16.	What is a flying capacitor?	BTL-3	Apply	CO3
17.	What is the main feature of the cascaded multilevel inverter?	BTL-3	Apply	CO3
18.	What is the basic concept of multilevel inverter?	BTL-4	Analyze	CO3
19.	What are the disadvantages of diode clamped multilevel inverter?	BTL-4	Analyze	CO3
20.	What are features of diode-clamped inverter?	BTL-1	Remember	CO3
21	What are the methods of reduction of harmonic content?	BTL-3	Apply	CO3
22	Discuss the applications of an inverter.	BTL-4	Analyze	CO3
23	Discuss why diodes should be connected in anti parallel with the thyristors in inverter circuits.	BTL-4	Analyze	CO3
24	Specify the reasons why thyristors are not preferred for inverters	BTL-1	Remember	CO3

PART - B

1.	With circuit diagram and waveform explain the operation of five level flying capacitor multilevel inverter. (13)	BTL-2	Understand	CO3
2.	Explain the principle of operation of a single phase multilevel cascaded H-bridge inverter with neat diagrams (13)	BTL-2	Understand	CO3
3.	With a neat sketch explain the operation of diode clamped multilevel inverter. (13)	BTL-1	Remember	CO3
4.	i. Compare different multilevel inverters in terms of number of components per leg. (7) ii. Describe the applications of multilevel inverter for reactive power compensation. (6)	BTL-4	Analyze	CO3
5.	Explain the five-level capacitor clamped multilevel inverter with necessary circuits and waveforms. (13)	BTL-1	Remember	CO3
6.	i. What is multilevel inverter? List different types of multilevel inverters and explain its principle of operation. (7) ii. Compare different multilevel inverters based on the requirement of number of power electronic devices. (6)	BTL-2	Understand	CO3
7.	With a neat schematic diagram, explain the operation of a three-phase five level Cascaded Multilevel Inverter. Also list their merits. (13)	BTL-4	Analyze	CO3
8.	What is an asymmetric multilevel inverter? Explain how more output voltage is obtained with a smaller number of H bridge cells. (13)	BTL-3	Apply	CO3
9.	Draw and explain the diode clamped type MLI and discuss characteristics. (13)	BTL-1	Remember	CO3
10.	Draw and explain the Cascaded type MLI and discuss characteristics. (13)	BTL-1	Remember	CO3
11.	Explain the operation of FCML inverter in details. (13)	BTL-6	Create	CO3
12.	Draw and explain the Basic concept of multilevel inverter? (13)	BTL-3	Apply	CO3
13.	With neat diagram describe the operation of diode-clamped multilevel inverter. Also explain applications of multilevel inverter? (13)	BTL-5	Evaluate	CO3
14.	Explain the features, applications, advantages and disadvantages of multilevel inverter. (13)	BTL-4	Analyze	CO3
15	Describe the concept of multilevel inverters with neat diagram and waveform. (13)	BTL-1	Remember	CO3
16	Explain the methods of reactive power compensation in multilevel inverters. (13)	BTL-6	Create	CO3
17	Briefly discuss about classifications of cascaded multilevel inverters. (13)	BTL-3	Apply	CO3
PART C				

1	Draw and explain the operation of a four-level diode clamped multilevel inverter. Write the inverter relationship for R phase. Derive the expression for transistor voltage, freewheeling diode current, capacitor junction current and clamping diode current. (15)	BTL-5	Evaluate	CO3
2	Compare and contrast the different configurations of multilevel inverters based on the various aspects involved in their design. (15)	BTL-6	Create	CO3
3	Explain the principles, features and applications of multilevel inverters. (15)	BTL-6	Create	CO3
4	How are the MLI used for reactive power compensator and controlling the flow the power between two systems? Discuss. (15)	BTL-5	Evaluate	CO3
5	Categorize the effects of multilevel inverters on switch stress and how these effects are eliminated with conventional elements. (15)	BTL-6	Create	CO3

UNIT IV AC-AC CONVERTERS WITH AND WITHOUT DC LINK

Matrix converters. Basic topology of matrix converter; Commutation – current path; Modulation techniques - scalar modulation, indirect modulation; Matrix converter as only AC-DC converter; AC-AC converter with DC link - topologies and operation - with and without resonance link - converter with dc link converter; Performance comparison with matrix converter with DC link converters.

PART - A

Q.No	Questions	BTL Level	Domain	COs
1.	What is a matrix converter?	BTL-2	Understand	CO4
2.	What are the advantages of using matrix converter?	BTL-1	Remember	CO4
3.	What are the disadvantages of matrix converter?	BTL-1	Remember	CO4
4.	Write the control methods of matrix converter.	BTL-6	Create	CO4
5.	Define Commutation.	BTL-5	Evaluate	CO4
6.	Draw the basic topology of matrix converter.	BTL-3	Apply	CO4
7.	Write the transfer matrix that represents the state of the converter matrix.	BTL-1	Remember	CO4
8.	Define Dead time commutation.	BTL-6	Create	CO4
9.	Define overlap commutation.	BTL-2	Understand	CO4
10.	What are the two ways to perform safe commutation?	BTL-2	Understand	CO4
11.	What are the steps to perform commutation in matrix converter?	BTL-1	Remember	CO4
12.	Define Scalar modulation.	BTL-5	Evaluate	CO4
13.	What is meant by indirect modulation?	BTL-1	Remember	CO4
14.	Draw the circuit diagram of AC-AC converter with DC link.	BTL-4	Analyse	CO4
15.	What is meant by resonant dc link converter?	BTL-2	Understand	CO4

16.	What are the advantage and disadvantage of DC link converter?	BTL-3	Apply	CO4
17.	Compare the performance of matrix converter with DC link converter.	BTL-3	Apply	CO4
18.	What are the types of resonant DC link converter?	BTL-4	Analyze	CO4
19.	Draw the circuit diagram of AC-AC converter without DC link.	BTL-4	Analyse	CO4
20.	Draw the circuit diagram of parallel resonant DC link converter.	BTL-1	Remember	CO4
21	What is AC to AC Converter?	BTL-3	Apply	CO4
22	Write the types of AC-AC converters.	BTL-4	Analyze	CO4
23	List the types of modulation in Matrix converter.	BTL-4	Analyse	CO4
24	Draw the circuit diagram for two step current commutation strategy.	BTL-1	Remember	CO4
PART - B				
1.	Explain the basic topology of matrix converter. (13)	BTL-2	Understand	CO4
2.	With circuit diagram, explain the current path using two step commutation strategy. (13)	BTL-2	Understand	CO4
3.	Explain the principle of operation of active and passive clamped resonant converters. (13)	BTL-1	Remember	CO4
4.	Explain in detail about the scalar and indirect modulation in matrix converter. (13)	BTL-4	Analyse	CO4
5.	Explain in detail about the topology and operation of AC-AC converter with resonant link. (13)	BTL-1	Remember	CO4
6.	Briefly explain the bidirectional switch commutation techniques. (13)	BTL-2	Understand	CO4
7.	With neat circuit diagram explain the topology and operation of AC-AC Converter with DC Link. (13)	BTL-4	Analyse	CO4
8.	With neat circuit diagram, explain the principle of operation parallel resonant DC link and Series resonant link DC converter. (13)	BTL-3	Apply	CO4
9.	Explain in detail about the topology and operation of AC-AC converter without resonant link. (13)	BTL-1	Remember	CO4
10.	Explain the current path in matrix converter with four step commutation strategy. (13)	BTL-1	Remember	CO4
11.	With neat circuit diagram, explain the principle of operation pole commutated DC link converter. (13)	BTL-6	Create	CO4
12.	Explain the modulation techniques for matrix converter. (13)	BTL-3	Apply	CO4
13.	With neat circuit diagram explain the topology and operation of AC-AC Converter without DC Link.	BTL-5	Evaluate	CO4
14.	Compare the operation of Matrix converter with DC Link Converter. (13)	BTL-4	Analyse	CO4

15.	Explain the principle of operation parallel resonant DC link and Series resonant link DC converter.	BTL-1	Remember	CO4
16.	With neat diagram, explain the basic topology of matrix converter. (13)	BTL-6	Create	CO4
17.	Explain the operation of AC-AC converter without resonant link. (13)	BTL-3	Apply	CO4
	PART C			
1	A single-phase full wave ac voltage controller has a resistive load of 5Ω and an input voltage 230 V, 50 Hz. The firing angle of thyristors T_1 and T_2 is 120 degree. Evaluate the (i) the RMS value of load voltage (ii)input power factor, (iii)average value of current of thyristor (iv)RMS current of thyristor (v)load power. (15)	BTL-5	Evaluate	CO4
2	Examine the operation of a 3phase AC voltage regulator having six thyristors with neat sketches of voltage waveforms. (15)	BTL-6	Create	CO4
3	Explain the basic topology and operation of matrix converter with its modulation strategies. (15)	BTL-6	Create	CO4
4	i. Compare the Cyclo converter and DC link converter. (8) ii. Explain the matrix converter. (7)	BTL-5	Evaluate	CO4
5	Explain the commutation strategies of matrix converter. (15)	BTL-5	Evaluate	CO4
	UNIT V SOFT-SWITCHING POWER CONVERTERS			
	Soft switching techniques. ZVS, ZCS, quasi resonance operation; Performance comparison hard switched and soft switched converters.AC-DC converter, DC-DC converter, DC-AC converter.; Resonant DC power supplies.			
	PART - A			
Q.No	**Questio**	**BTL Level**	**Domain**	**COs**
1.	What are the advantages of ZCS resonant converter?	BTL-2	Understand	CO5
2.	What is the principal of zero-voltage switching resonant converters?	BTL-1	Remember	CO5
3.	What is the principal of zero-current switching resonant converters?	BTL-1	Remember	CO5
4.	What are advantages of ZVS resonant converter?	BTL-6	Create	CO5
5.	Draw the circuit diagram of resonant dc-link inverter.	BTL-5	Evaluate	CO5
6.	Compare ZVS and ZCS.	BTL-3	Apply	CO5
7.	What is resonant DC-link inverter?	BTL-1	Remember	CO5
8.	Define ZVS resonant converter.	BTL-6	Create	CO5
9.	Define ZCS resonant Converter.	BTL-2	Understand	CO5
10.	What are resonant converters? List their merits over switched converters.	BTL-2	Understand	CO5
11.	Write the various categories of resonant converters.	BTL-1	Remember	CO5

12.	What is a quasi-resonant converter?	BTL-5	Evaluate	CO5
13.	Differentiate briefly between quasi resonant and resonant converter.	BTL-1	Remember	CO5
14.	What do you mean by resonant switch? List the favourable features over PWM Switches.	BTL-4	Analyze	CO5
15.	Define switching loss.	BTL-2	Understand	CO5
16.	Define the hard switching.	BTL-3	Apply	CO5
17.	Quote the basic principle of soft switching.	BTL-3	Apply	CO5
18.	What are the advantages of soft switching over hard switching?	BTL-4	Analyse	CO5
19.	Compare the hard switching and soft switching.	BTL-4	Analyse	CO5
20.	How is the output voltage controlled in a series resonant inverter?	BTL-1	Remember	CO5
21.	State the term soft switching.	BTL-3	Apply	CO5
22.	Define the term resonance.	BTL-4	Analyse	CO5
23.	Write the types of ZVS switching.	BTL-4	Analyse	CO5
24.	State the term hard switching.	BTL-1	Remember	CO5
	PART - B			
1.	Draw and explain the zero-current switching resonant converters. (13)	BTL-2	Understand	CO5
2.	Draw and explain the zero-voltage switching resonant converters. (13)	BTL-2	Understand	CO5
3.	Summarize the basic principles of soft switching and hard switching. (13)	BTL-1	Remember	CO5
4.	Compare the Zero Current Switching (ZCS)/ Zero Voltage Switching (ZVS). (13)	BTL-4	Analyse	CO5
5.	Draw and explain the various types of zero current and zero voltage switch topology. (13)	BTL-1	Remember	CO5
6.	Draw and explain briefly the operation of resonant dc link inverter. (13)	BTL-2	Understand	CO5
7.	With neat circuit diagram explain the principle of operation and working of Resonant DC Power supplies. (13)	BTL-4	Analyse	CO5
8.	Summarize the performance comparison of hard switched and soft switched converters. (13)	BTL-3	Apply	CO5
9.	With a help of neat circuit diagram and associated waveforms explain the operation of half wave and full wave mode of ZCS Resonant buck converters. (13)	BTL-1	Remember	CO5
10.	With a help of neat circuit diagram and associated waveforms explain the operation of half wave and full wave mode of ZVS Resonant buck converters. (13)	BTL-1	Remember	CO5
11.	With a help of neat circuit diagram and waveforms explain the operation of class E resonant rectifiers. (13)	BTL-6	Create	CO5

12.	Describe the operation of resonant DC link inverters with zero voltage switching. Draw necessary circuits and waveforms. (13)	BTL-3	Apply	CO5
13.	Draw and explain the operation of ZVS Forward and flyback converter. (13)	BTL-5	Evaluate	CO5
14.	Draw and explain the operation of ZVS half bridge and ZVS full bridge PWM converter. (13)	BTL-4	Analyse	CO5
15.	Explain in detail about L type ZCS resonant converter.	BTL-3	Apply	CO5
16.	Explain the operation of ZVS resonant converter with neat diagram and output waveforms	BTL-5	Evaluate	CO5
17.	Explain in detail about M type ZCS resonant converter with waveforms and circuit diagram.	BTL-4	Analyse	CO5
PART - C				
1.	Summarize the series loaded resonant converter and parallel loaded resonant converter. (15)	BTL-5	Evaluate	CO5
2.	Evaluate the Buck-Boost ZCS Quasi Resonant DC-DC Converter. (15)	BTL-6	Create	CO5
3.	Explain the types of ZCS Converter.	BTL-6	Create	CO5
4.	Explain the types of ZVS Converter.	BTL-5	Evaluate	CO5
5.	Elaborate on the comparison of soft switching and hard switching converters	BTL-6	Create	CO5

COURSE OUTCOME:

1. To understand the operation, classification and performance of Switched Mode Power Supplies.
2. To understand and Analyse Switched mode DC-AC Converters.
3. To understand the performance and operation of various types of Multilevel Inverter.
4. To study the performance operation of AC-AC Converters and matrix converters.
5. To understand the need to study Softs Switching converters.