Apr-25

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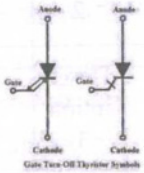
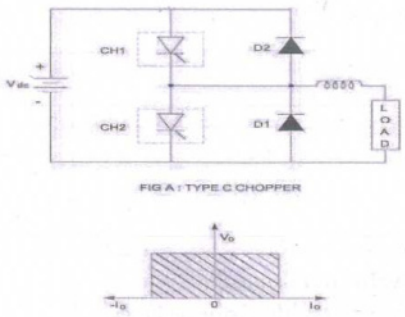
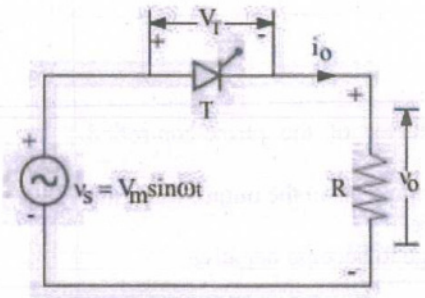
P-10

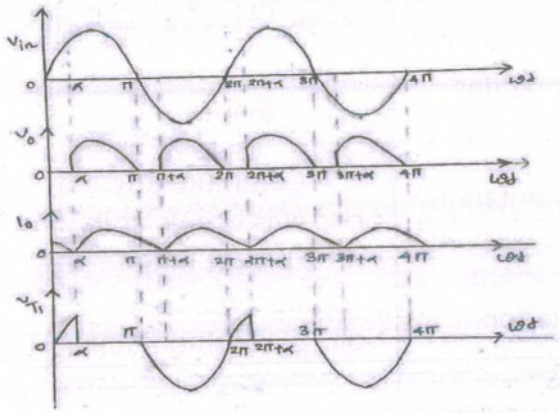
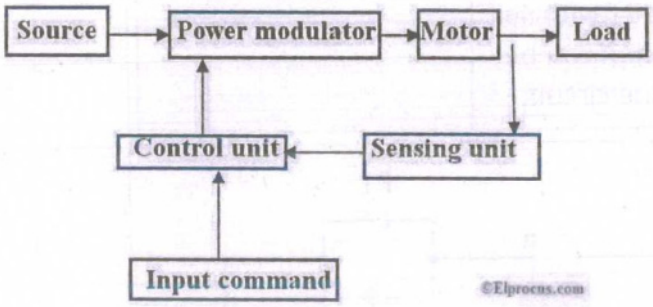
Scoring Indicators

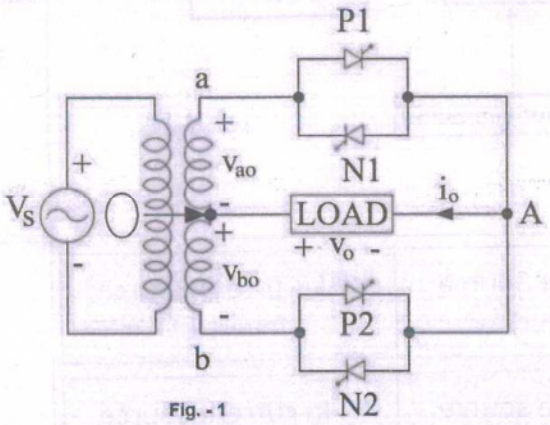
COURSE NAME: POWER ELECTRONICS DEVICES&CIRCUITS

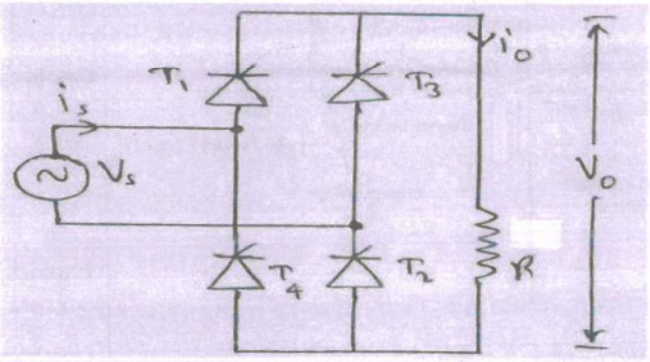
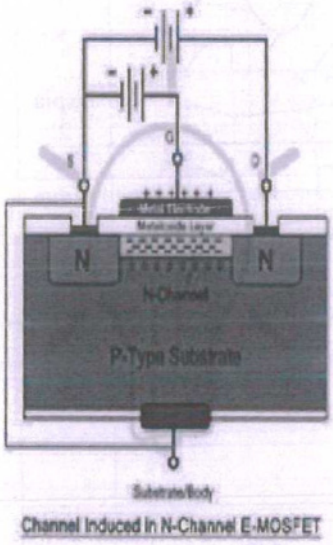
COURSE CODE: 4031 QID: 2103230076

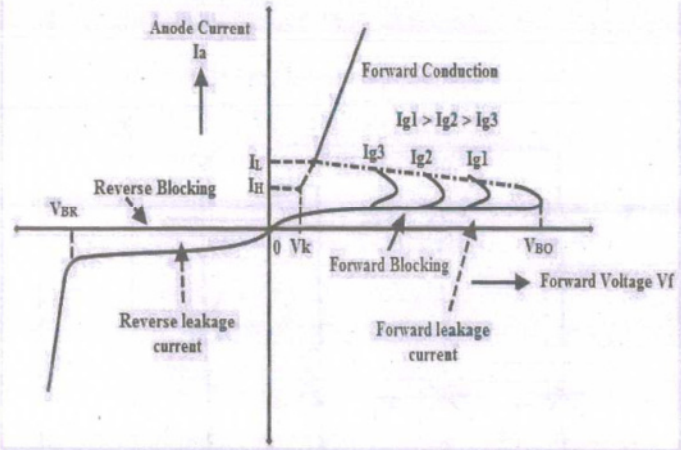
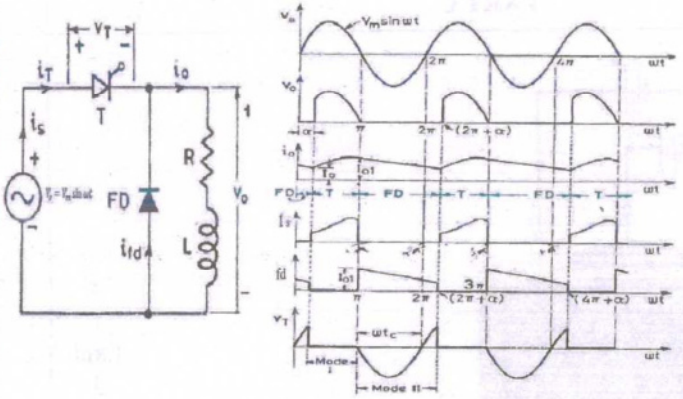
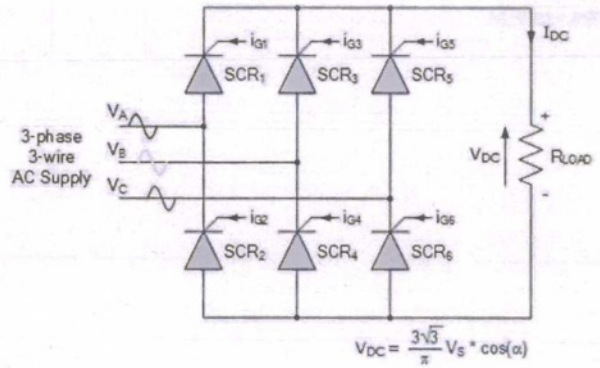
Q No	Scoring Indicators	Split score	Sub Total	Total Score
	PART A			
I. 1		1	1	1
I. 2	Latching current is the minimum value of current flowing through the anode that keeps turning on the thyristor or keeps in conducting state even after removing the gate pulse. ie it is the minimum current required to turn SCR from forward blocking mode to forward conduction mode	1	1	1
I. 3	A controlled rectifier is a type of AC to DC converter that provides adjustable DC output voltage from the given AC input supply.	1	1	1
I. 4	Light dimmer, AC Motor speed control, AC voltage regulator, AC Fan speed regulator	Any 2 1	1	1
I. 5	Power transistor or MOSFET	1	1	1
I. 6	1.Improves the input power factor of the phase-controlled rectifier 2.Helps to reduce the ripple components in the output when the load is highly inductive in nature 3.It does not allow output voltage to become negative	Any1 1	1	1
I. 7	To step down voltage	1	1	1
I. 8	Type E	1	1	1
I. 9	On line, Off line, Line interactive	Any 2 1	1	1

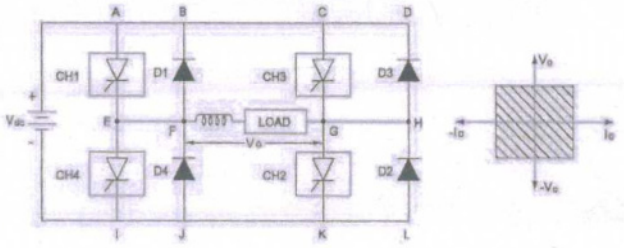
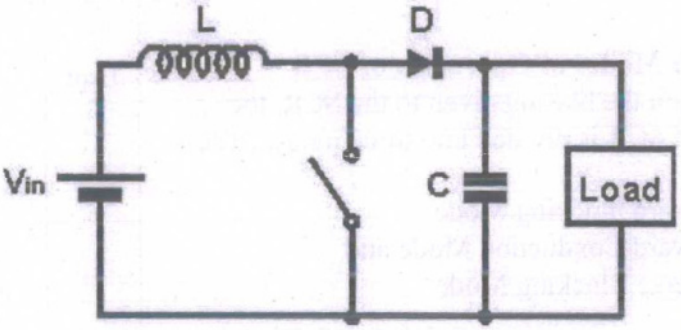
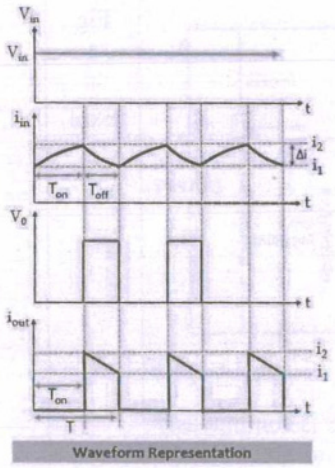
	PART B			
II. 1	• It is used in SMPS (Switched Mode Power Supply) to supply power to sensitive medical equipment and computers. • It is used in UPS (Uninterruptible Power Supply) system. • It is used in AC and DC motor drives offering speed control. • It is used in chopper and inverters. • It is used in solar inverters.	Any 3 1 mark each	3	3
II. 2	 FIG A : TYPE C CHOPPER The type C chopper is parallel combination of type A and type B chopper. The output voltage is always positive but output current either positive or negative in this type of chopper therefore it works in first as well as second quadrant.	Fig: 2 + Description 1	3	3
II. 3	v_0 = Load output voltage i_0 = Load current V_T = Voltage across the thyristor T 	3	3	3

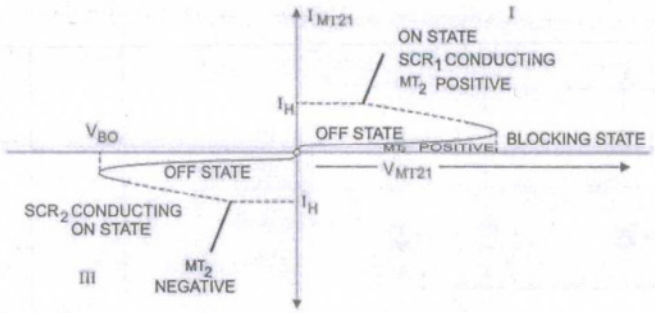
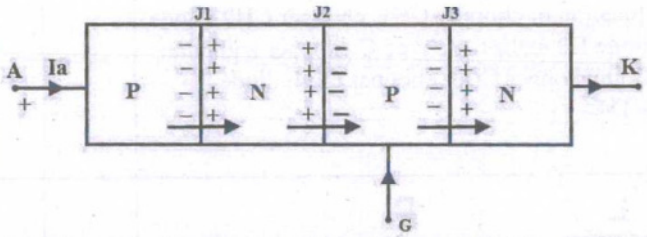
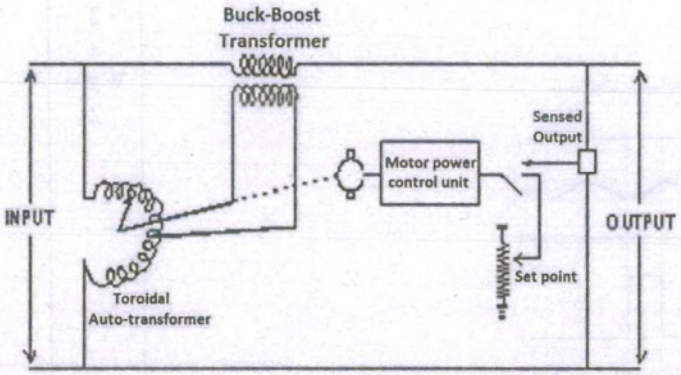
<table>
<tr><td>II. 4</td><td>  </td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>II. 5</td><td> 
</td><td>Diagram+ explanation
3</td><td>3</td><td>3</td></tr>
<tr><td>II. 6</td><td>
<table>
<tr><th>VSI (Voltage Source Inverter)</th><th>CSI (Current Source Inverter)</th></tr>
<tr><td>1. In voltage source inverter input voltage is kept constant.</td><td>1. In current source inverter input current is kept constant.</td></tr>
<tr><td>2. VSI is fed from a DC voltage source having small or negligible impedance.</td><td>2. CSI is fed with adjustable current source from a DC voltage source of high impedance.</td></tr>
<tr><td>3. DC source in parallel with large capacitor.</td><td>3. VSI can be converted into CSI, By connecting large series inductance.</td></tr>
<tr><td>4. An output voltage is independent of load.</td><td>5. An output current is independent of load</td></tr>
</table>
</td><td>any
3</td><td>3</td><td>3</td></tr>
</table>

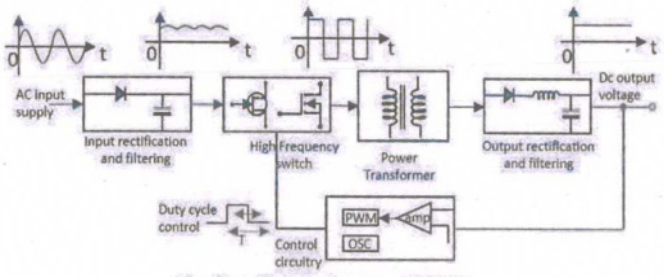
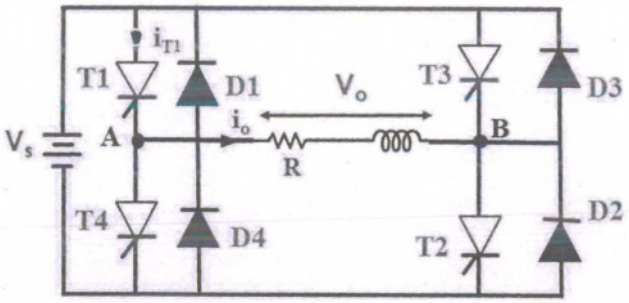
	5. VSI has slow response	5. CSI has fast response		
	6. VSI requires feedback diodes	6. The CSI does not require any feedback diodes.		
	7. The commutation circuit is complicated. It uses current commutation.	7. Commutation circuit is simple as it contains only capacitors. It uses voltage commutation.		
	8. Power BJT, Power MOSFET, IGBT with self commutation can be used in the circuit.	8. Thyristors are Used.		
II. 7	 Fig. - 1		3	3	3
II. 8	The angle in the AC cycle at which the thyristor starts conducting at the application of positive voltage to gate is known as the firing angle α The number of degrees in a half cycle for which SCR is turned on is known as conduction angle ie π- α		1.5 1.5	3	3
II. 9	Vin=600V Vo=200V Duty cycle=Vo/Vi =200/600 = 0.33 Ton=200 μs T=D x Ton =0.33x200=66.66μs f =1/T =1/66.66μs =1500 Hz =15 KHz		1.5 1.5	3	3

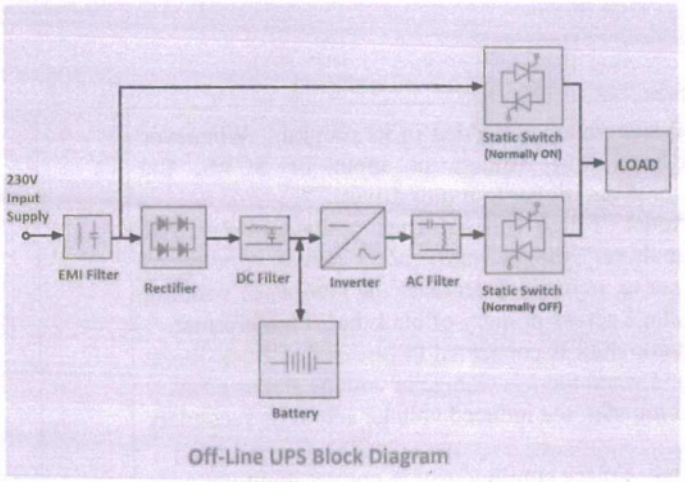
II. 10		3	3	3
	PART C			
III	 Channel Induced in N-Channel E-MOSFET	Fig 4 + Expl 3	7	7

IV	 Explain IL,IH,VBO,VBR	Graph +marking 4 Expla 3	7	7
V		Fig 3 + Expla 2 + Wave 2	7	7
VI		Fig: 4 Marks + expl 3	7	7

VII	 FIG A : TYPE E CHOPPER The type E chopper is a four quadrant chopper. The type E chopper is parallel combination of two type C chopper. The combination of chopper CH1, chopper CH2, diode D1 and diode D2 makes one type C chopper and other is made from chopper CH3, chopper CH4, diode D3 and diode D4.	Fig 4 + Exp 3	7	7
VIII	  Waveform Representation	Fig 3 +exp 2 + Wave 2	7	7

IX	 V-I Characteristic of a Triac	Fig 4 + Expl 3	7	7
X	 **Working or Modes of Operation of SCR** Depending on the biasing given to the SCR, the operation of SCR is divided into three modes. They are 1. Forward blocking Mode 2. Forward Conduction Mode and 3. Reverse Blocking Mode	Fig:4 Expl 3	7	7
XI	 Voltage received from mains at input of SCVS is continuously sensed by sensing circuit and gives feedback to main control circuit which consists of a microprocessor. This microprocessor continuously receives values of input voltages and compares	Fig 4 + Expl 3	7	7

	with the reference value embedded in its program. Whenever there is high or low voltage at input of SCVS, the microprocessor gives trigger to motor driver. Based on amount of high voltage or low voltage observed at input, "motor driver" moves servo motor across winding of autotransformer to increase or decrease the number of winding and hence voltage across primary of buck-boost transformer. The Servo motor shaft is connected to primary of Buck-Boost transformer and when there is change in voltage across primary of buck-boost transfer, the induced voltage across its secondary also changes. This process takes place continuously to correct input voltages			
XII	 Functional block diagram of SMPS	Diagram 4 + Expl 3	7	7
XIII	 The operation of full Bridge Inverter is divided into four modes. 1. **Mode I: (t1< t < T/2) T1, T2 on** 2. **Mode II: (T/2 < t < t2) D3, D4 on** 3. **Mode III: (t2 < t < T) T3, T4 on** 4. **Mode IV: (0 < t < t1) D1, D2 on**	Fig- 4 Expl: 3	7	7

XIV	 Off-Line UPS Block Diagram	Fig- 4 Expl-3	7	7