MODEL ANSWER

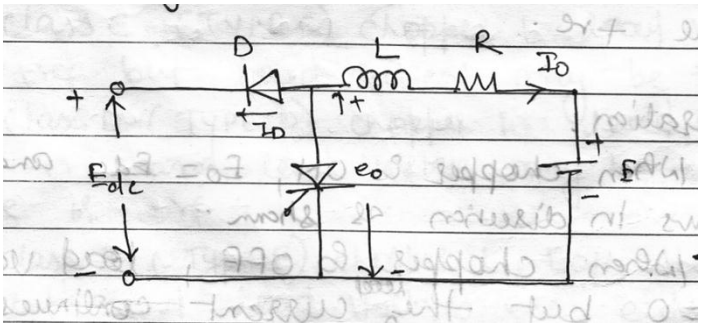
SUMMER– 17 EXAMINATION

Subject Title: Industrial electronics and applications Subject Code: 17541

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for anyequivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

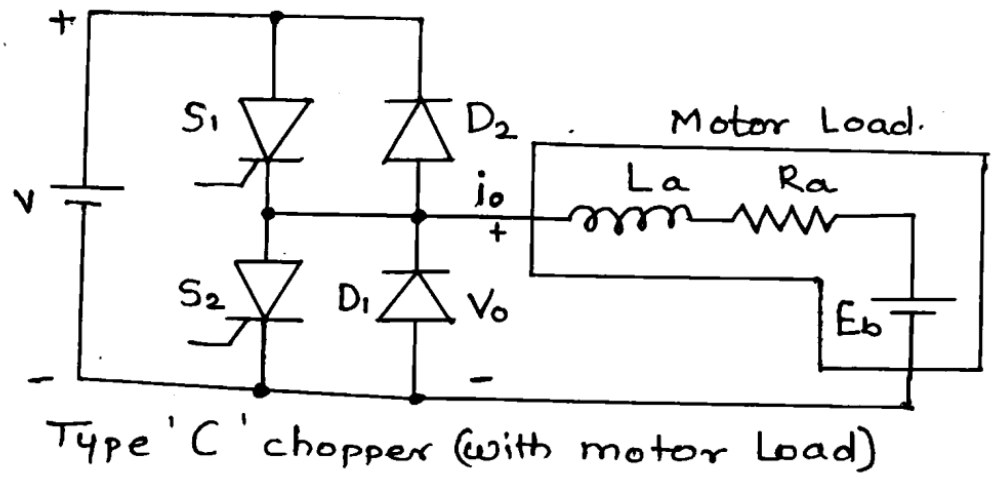
Q. No.	Sub Q.N.	Answer	Marking Scheme
Q.1		**Attempt any THREE of the following :**	**12-Total Marks**
	(i)	**State the reason of unequal voltage distribution in case of series connection of SCR. What is remedy?**	**4M**
	Ans:	***Note: Also give marks if shown in diagram.*** **Reason:** There is unequal distribution of voltage when SCRs are connected in series due to differences in the static resistance of the devices. Hence, to overcome this drawback, static equalizing circuit is used. **Remedy:** Each SCR is connected across an external resistance in shunt to compensate for unequal sharing of voltages.	**Reason: 2M** **Remedy:2 M**
	(ii)	**List different types of inverter. State any two applications of inverter.**	**4M**
	Ans:	**Different types of inverters: (any four)** 1. Voltage source inverter 2. Current source inverter 3. Series inverter 4. parallel inverter 5. Half bridge inverter 6. Full bridge inverter	**2M**

	7. PWM inverter **Application:** 1. In the UPS systems. 2. In the speed control of ac motors. 3. In induction heating. 4. In emergency light systems. 5. In HVDC transmission 6. In the communication equipments.	**2M**
(iii)	**Describe operation of class B chopper with the help of neat diagram.**	**4M**
Ans:	**Diagram:**  **Explaination**: When SCR is turned on inductor stores the energy. When SCR is turned off energy stored by the inductor is dissipated through the diode. Hence we obtained the output voltage greater than input.	**2M** **2M**
(iv)	**Compare relay type and tap changing phase control type voltage stabilizers with respect to working principle, efficiency, distortion and application.**	**4M**
		4M

Sr No	Parameter	Relay type voltage stabilizer	Tap changing phase control
1	Principle	Relay contacts select tap on transformer	Output voltage changes by changing the firing angle of SCRs
2	Efficiency	70%	70%
3	Distortion	Less distortion	more distortion
4	Application	TV, refrigerator	T.V, Fridge

B)	**Attempt any ONE of the following :**	**6M**
(i)	**Describe working of class C chopper using SCR_S, with circuit diagram and waveforms.**	**6M**
Ans:		

Diagram:



3M

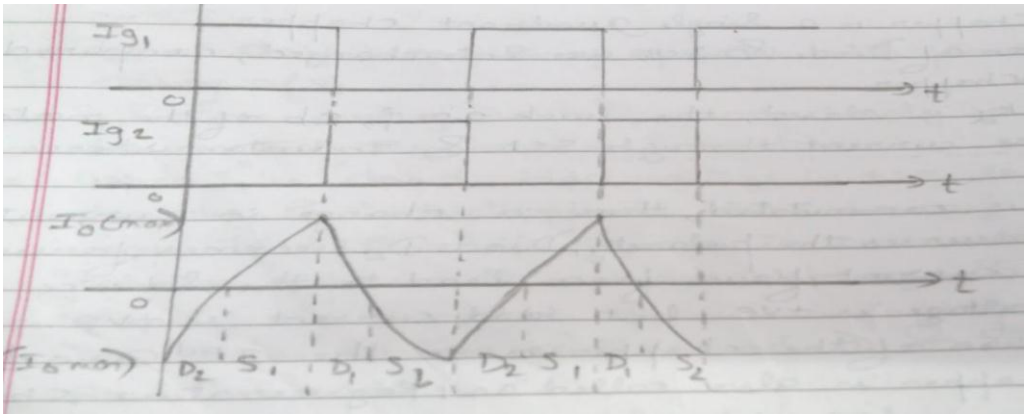
Explanation:

Type C chopper:

- Thyristor S1 and diode D1 operates as a type A chopper .
- Thyristor S2 and Diode D2 works as a type B chopper.
- When Thyristor S1 is triggered, diode D1 conducts and the load current is positive.
- When thyristor S2 is ON , Diode D2 conducts and the load current is negative .

2M

Waveforms:



1M

(ii)	**State operating principle of basic series inverter using circuit diagram & waveforms.**	**6M**
Ans:	**Operating principle:** When S1 (T1) is triggered the capacitor starts charging with left plate positive with respect to right and when the voltage on capacitor is slightly greater than Edc then T1 turns off; but there is no discharge path for capacitor hence it holds the charge. When trigger pulse is applied to T2, then T2 start conducting so current starts flowing in opposite direction. In this way due to charge and discharge of capacitor and switching of T1 and T2 current will flow in RC. Hence sinusoidal current starts flowing in the load.	**2M**

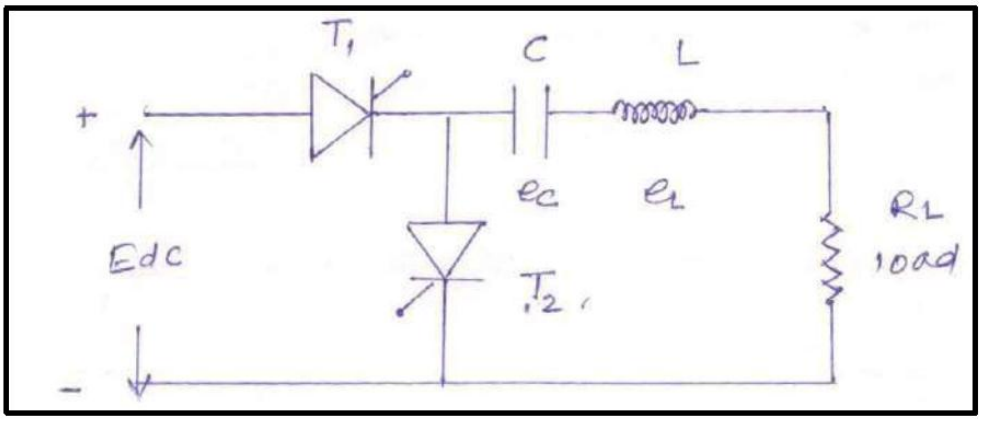
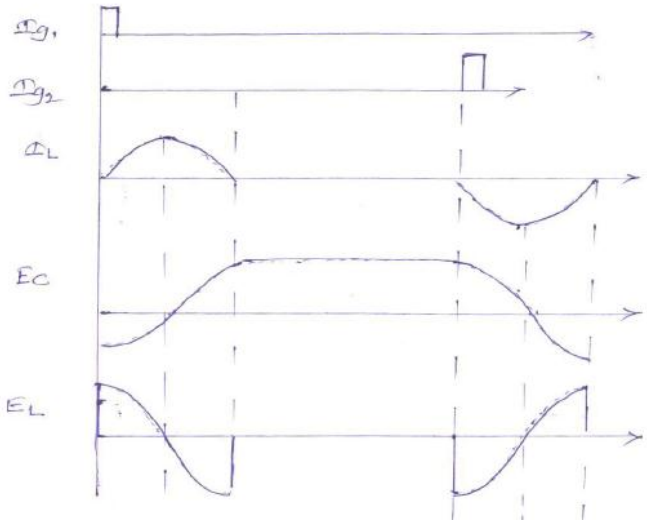
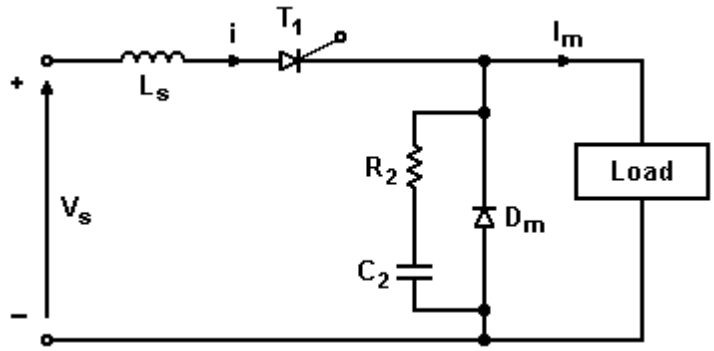
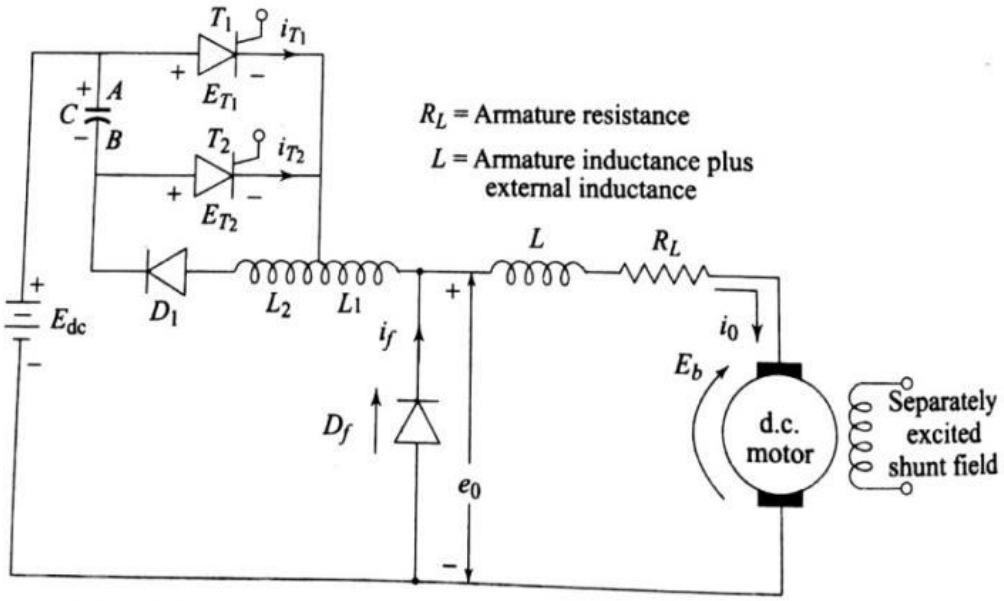
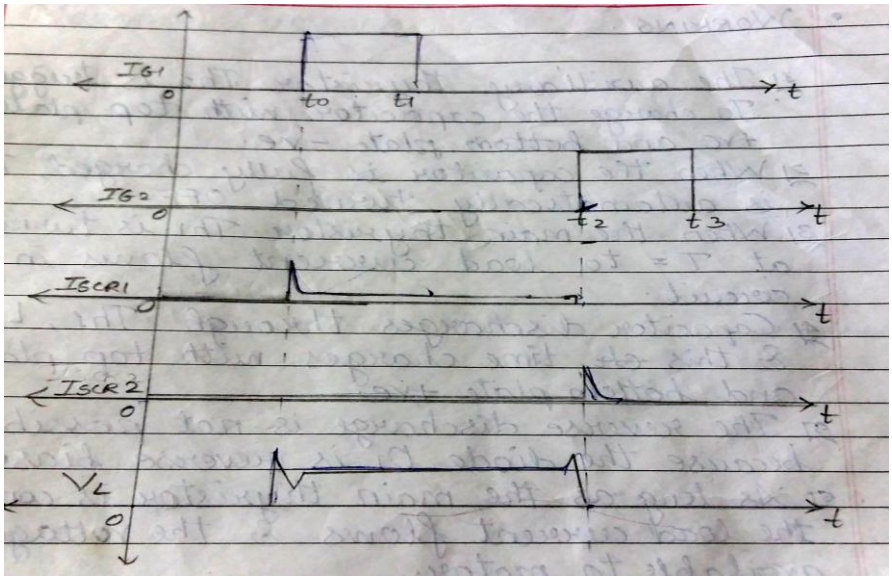
		Circuit diagram:  **Waveforms:** 	**3M** **1M**
Q 2		**Attempt any TWO of the following :**	**16M**
	(a)	**What is the need of snubber circuit for power devices? Explain how to protect thyristor against high dv/dt and high di/dt.**	**8M**
	Ans:	**Need of snubber circuit-** Snubber circuit is used to protect thyristors from high di/dt and high dv/dt. If di/dt is high it can cause heating of the device and subsequent damage to the device. If dv/dt is large, it can cause false turn-on of the device. **How to protect:** Protection against high di/dt and high dv/dt: RL snubber circuit is used for di/dt protection. It consists of inductor in series with the device to be protected RC Snubber circuit is uesd for high dv/dt protection. It consists of a series combination of Resistor and capacitor across the device to be protected.	**2M** **(Protection from di/dt::2M)** **(Protection from dv/dt::2M)**

	Diagram: 	**2M**
(b)	**With the help of neat circuit diagram and waveforms, explain Jone's chopper. Give any two applications of it.**	**8M**
Ans:	**Circuit diagram:** 	**3M**
	Explanation: Let us assume, that initially capacitor C is charged to a voltage Edc with the polarity shown in the fig. • **SCR T1 is triggered;** a load current flows through T1, L1 and the load. • Simultaneously current flows through the path CA-T1 - L2 - D1 - CB and capacitor C discharges and reverses its polarity i.e. plate B is positive and plate A is negative. • Diode D1 prevents the reverse discharge. • Hence, capacitor C holds its charge until SCR T2 is triggered. • When **SCR T2 is triggered** current flows through the path CB - T2 - T1 - CA. • The capacitor voltage with reverse polarity is applied across the thyristor T1which reverse biases SCR T1 and turns it OFF. • The capacitor again charges up through supply, C, SCR T2, L1, load with the plate A	**3M**

positive and SCR T2 turns OFF because the current through it falls below the rated holding current value when capacitor C is recharged.

The load current flows through the freewheeling diode Df until the thyristor T1 is turned ON again, and thus, the cycle repeats itself.

Waveform:



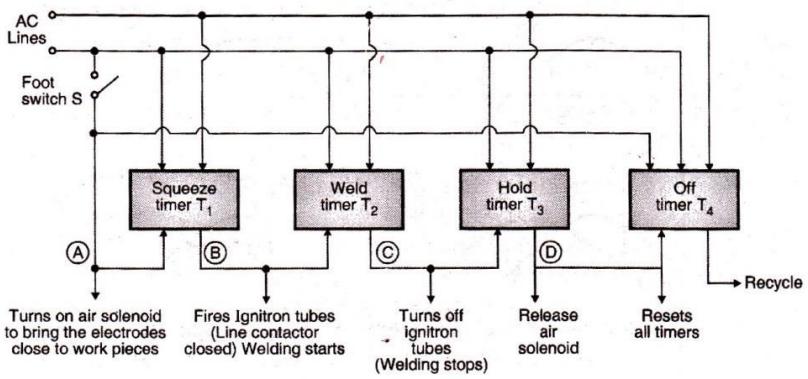
1M

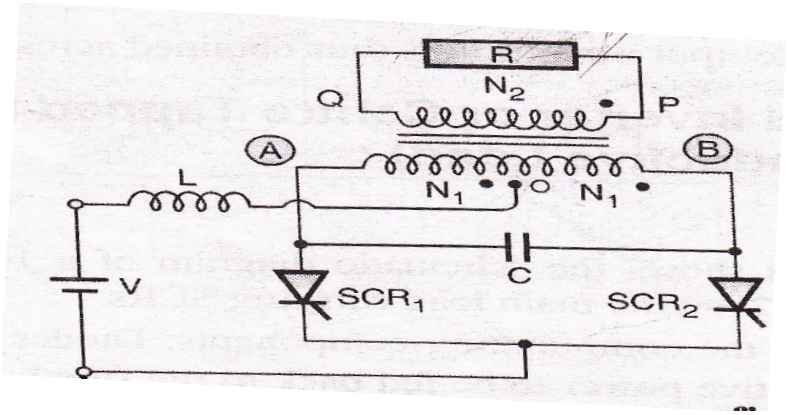
Applications:

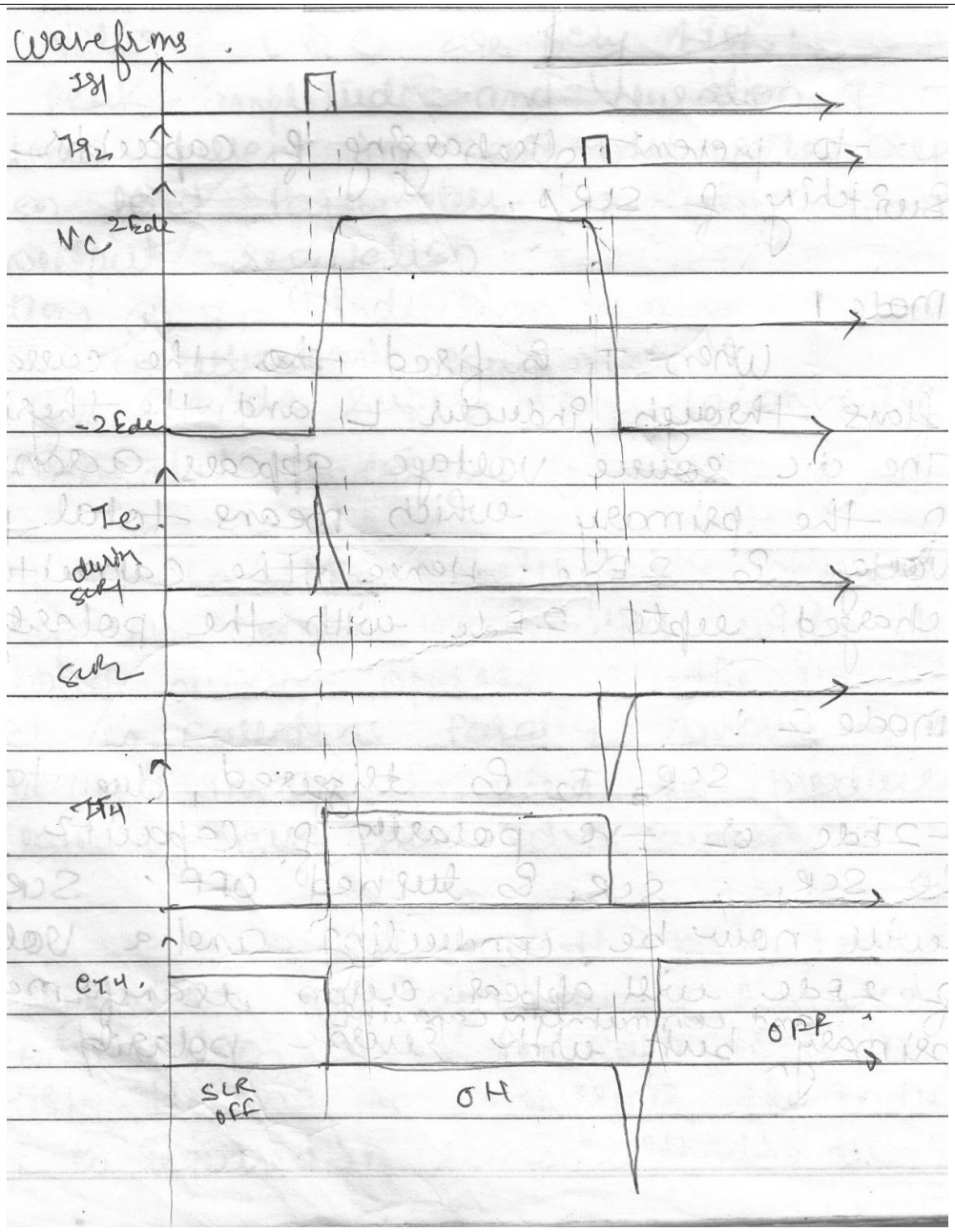
1.Speed control of DC motor

2. Traction control

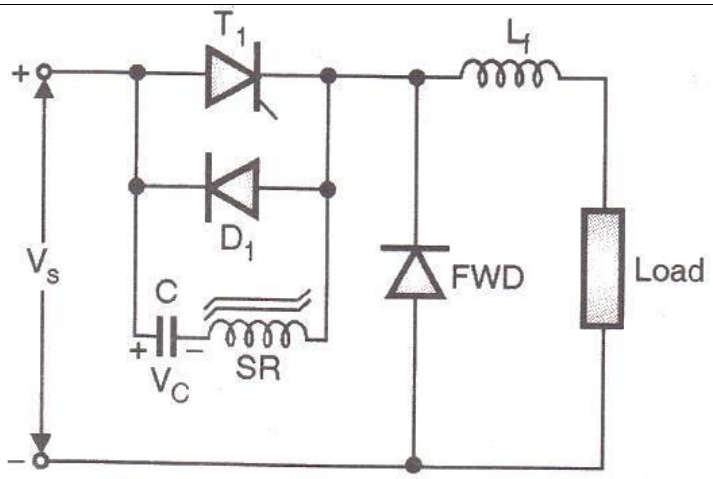
1M

(c)	**Draw block diagram of sequential timer for resistance welding. Describe function of each block. List different signals generated.**	**8M**
Ans:	**Block diagram:**  **Functions:** • Squeeze timer- it turns on the solenoid valve and squeezes the welding electrodes together. • Weld timer- it operates to initiate the welding current • Hold timer- it will produce control signals to hold the welding current.	**4M** **2M**

		• Off timer- during this time the operator can shift the work-piece to a new spot. **The sequential timer provides the following signals**: • Signal to squeeze the welding electrodes together. • Signal to start the flow of welding current • Signal to stop the flow of welding current • Signal to separate the electrodes.	**2M**
Q. 3		**Attempt any FOUR of the following :**	**16M**
	(a)	**Draw circuit diagram & waveforms for parallel inverter using $SCR_S$with purely resistive load. Describe its working.**	**4M**
	Ans:	**Diagram :**  **Working:** SCR1 and SCR2 are switched alernately to connect the input dc source.This induces square wave voltage across the load in the transformer. C is commutating Capacitor. Mode1: When SCrR 1 is turned On , the dc source voltage appears across left half of primary OA The primary current flow from O to A. Due to0 the transformer action the voltage between AB is 2V Volts. Hence the capacitor is charged to a voltage of 2V Volts. The load voltage is positive, so is the load current. Mode II: The firing of SCR2 turns off SCR, by the principle of parallel capacitor communication. (The capacitor voltage is applied across SCR, directly to reverse bias it). The input de vot\ltage now gets connected across winding OB. The primary current flows form O to B through SCR2 The load voltage changes its polarity and the direction of load current is reversed. The square wave is optained at the output . **Waveforms:**	**2M** **1M** **1M**



(b)	**Describe operation of Morgan's chopper with neat diagram & waveforms.**	**4M**
Ans:	**<u>Diagram:</u>**	**2M**



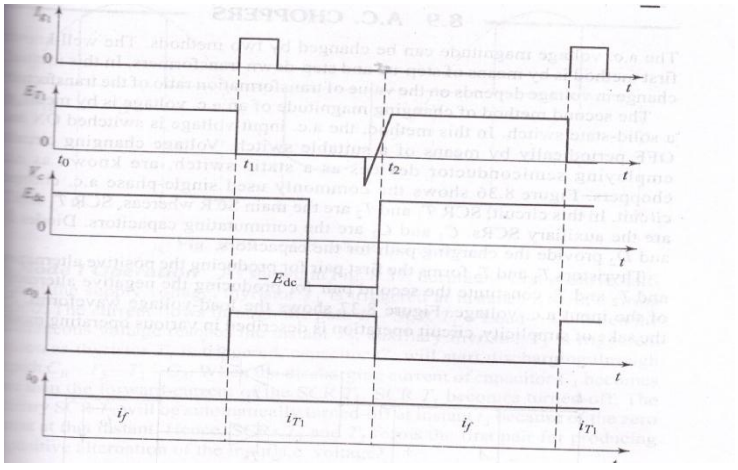
Note:Give marks for other relevant configuration with tapped inductor also. **1M**

Explanation:

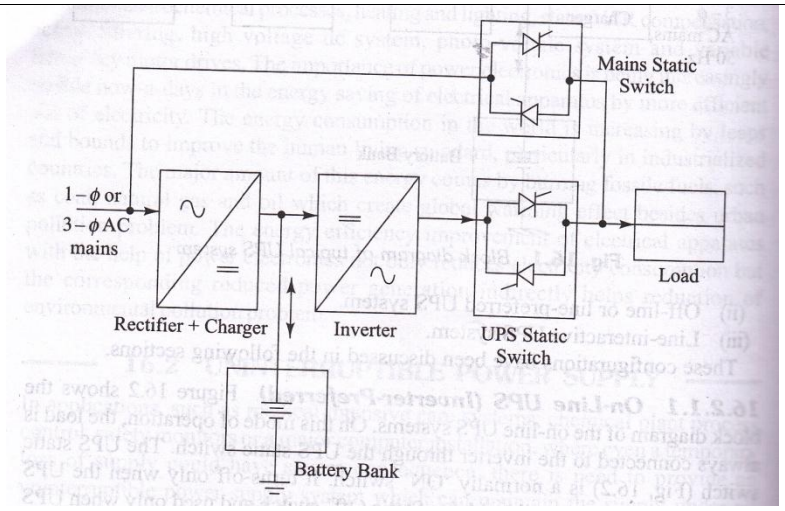
- Initially SCR T1 is in the OFF state.
- C1 is charged to the supply voltage Edc and the reactor SR is positive saturated.
- When T1 is triggered, capacitor discharges through T1 and SR.
- After a short period, charge on the capacitor is reversed and the reactor is negatively saturated.
- The impedance of the reactor reduces.
- The reverse voltage of capacitor appears across T1 and turns it off.

1M

Waveform:



(c)	**Which type of UPS is used for medical applications ? Draw related block diagram & explain operation of each block.**	**4M**
Ans:	ON Line UPS system is used for medical application.	**1M**
	Block diagram:	



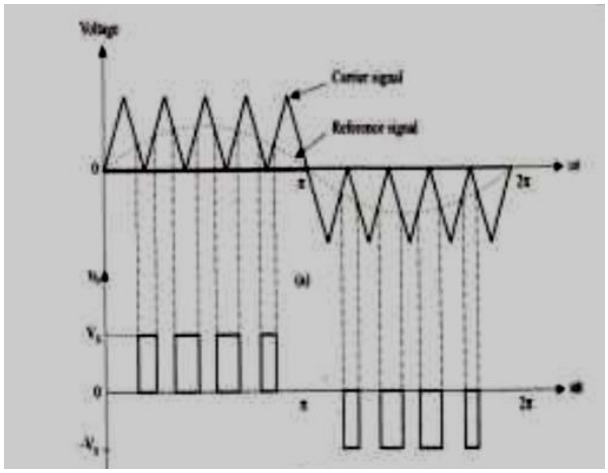
2M

Explanation:

In ON line UPS the rectifier is used to convert a.c. supply to DC supply which supplies power to the inverter as well as the battery bank to keep it charged.
Inverter is used to convert DC to AC supply.
In this, UPS Static Switch is normally ON.
Mains static switch is Normally OFF and used only when UPS is to be bypassed.
When UPS fails the UPS Static switch which is normally ON is made OFF and Mains static switch is made ON to connect AC supply directly to load.

1M

(d)	**What are different PWM techniques to control output voltage & harmonics of a inverter ? Explain any one of them.**	**4M**
Ans:	The most efficient of controlling the gain and output voltage is to incorporate pulse width modulation control within the inverter. The commonly used PWM techniques are as follows- 1) Sinusoidal pulse width modulation 2) Single pulse width modulation 3) Multiple pulse width modulation ***Note:Anyone of the following*** Sinusoidal pulse width modulation	**(Techniques- 1M,explaination- 2M waveform- 1 M)**



The PWM waveform generated at the output of the controlled circuit is used to drive

transistors or other semiconductor devices connected in the inverter circuit. This type of modulation is realized by comparing a control signal consisting of reference sinusoidal wave of variable magnitude Am and frequency fm= 1/T equal to frequency of inverter & a triangular wave of fixed amplitude and frequency. The comparator output is high when the magnitude of sine wave is greater than that of triangular wave. The modulation index of PWM signal is defined as the ratio of: Am/ Ac.The carrier frequency ratio is defined as the ratio of fc to fm. This method reduces the harmonics present in the output waveform. A pure quasi square wave is obtained. For further reduction in harmonics filter can be used.

OR

2 Single Pulse-Width Modulation:-

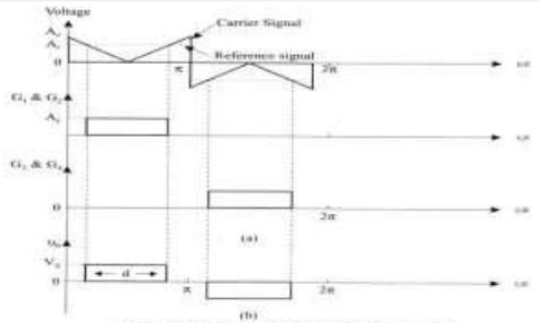


Figure Waveforms of single-pulse width modulation: (a) gate signal generation; (b) output voltage.

In single -pulse-width modulation control, there is only one pulse per half-cycle and the width of the pulse is varied to control the inverter output voltage. The gating signals are generated by comparing a rectangular reference signal of amplitude Ar with a triangular carrier wave of amplitude Ac.

OR

Multiple Pulse-Width Modulation:-

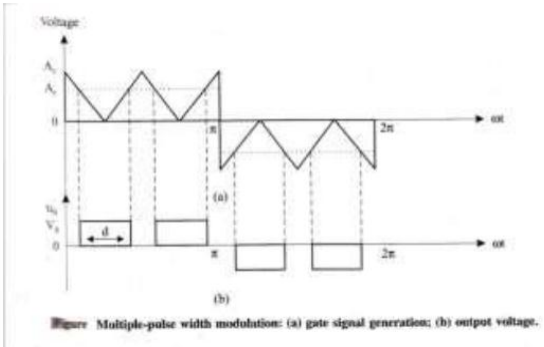
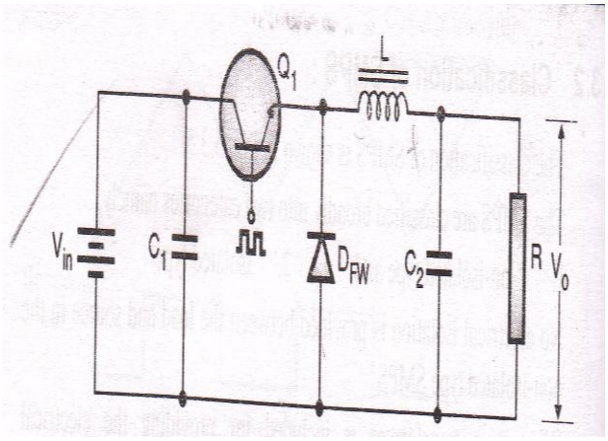
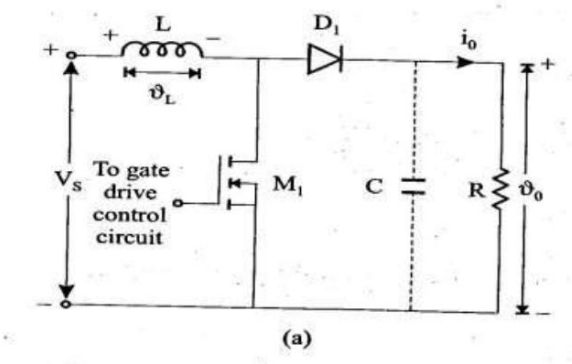
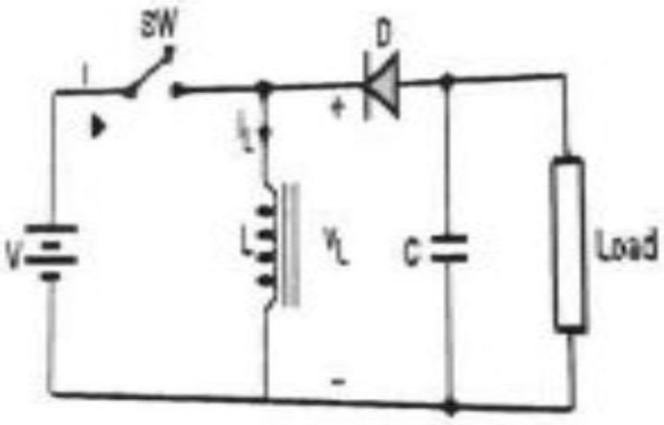


Figure Multiple-pulse width modulation: (a) gate signal generation; (b) output voltage.

In this method of pulse-width modulation, the harmonic content can be reduced using several pulses in each half-cycle of output voltage. By comparing a reference signal with a triangular carrier wave, the gating signals are generated for turning-on and turning-off

	of a thyristor. fc>fm.	
(e)	**Draw circuit diagram & explain working of non-isolated SMPS.**	**4M**
Ans:	***Note: Any one type can be considered***	
	1. Buck Regulator: 	**2M**
	Explanation: The circuit arrangement of such a regulator is shown in figure. Here, switching control is done by a power BJT. When the transistor Q1 is switched on, the diode Dfw becomes reverse biased and the input provides energy to the lead as well as to the inductor. When the transistor is switched off, an inductor current flows through the flywheel diode Dfw, transferring some of its stored energy to the load. This inductor current falls until the transistor is switched on again in the next cycle. The filter capacitor at the output is assumed to be very large, so that a nearly constant instantaneous output voltage is obtained	**2M**
	OR	
	2.Boost Regulator :  (a)	
	Explanation: When the transistor M1 is switched on, the input current flows through the inductor L and the transistor M1.	

		The flywheel diode D1 is reverse biased in this case and thus isolates the output stage. When the transistor is switched off, the output stage receives a voltage from the inductor along with the supply voltage. This means that the output voltage of the boost regulator is always greater than the input voltage, hence the name boost. The voltage at the output can be regulated by adjusting the duty ratio of the circuit. **OR** **3. Buck-Boost Regulator:**  **Explanation:** When Q1 is turned ON the supply voltage V gets connected across the inductance L. The inductance current starts increasing linearly. Diode D1 is reverse biased in this mode. Inductor stores energy. Q1 is OFF the current through inductor is interrupted. Negative voltage is induced into L which will forward biased D1. The load current flows through D1 and L. C charges by lower plate positive w.r.t upper plate. Mode ends when current through diode reaches zero Mode 3: When all devices are OFF the C will discharge through load due to which output voltage will be negative.	
Q. 4	**(A)**	**Attempt any THREE of the following :**	**12M**
	(i)	**What do you mean by Resonant inverter? State any two advantages and disadvantages.**	**4M**
	Ans:	The inverters that uses some form of LC resonant Circuits are called as Resonant inverter.They are also called as self commutating. No separate commutation circuits are required. The L & C forms an under damped resonant circuit. **Advantages-** 1.Switching losses are minimized 2.RFI/EMI interferences are reduced 3. Size and weight of the circuit is reduced 4.High frequency harmonics at the output is reduced	**(Definition-2M Advantages 1M Disadvantage 1M)**

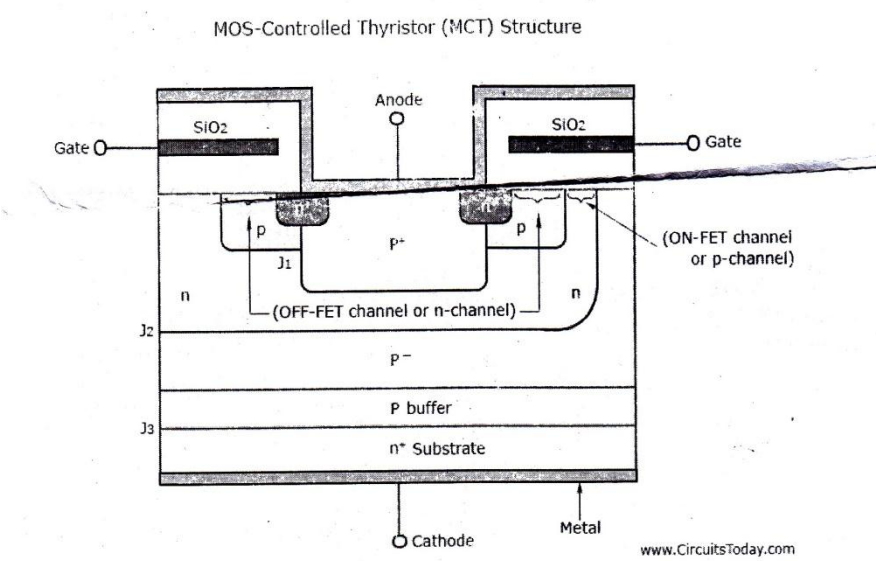
Disadvantages-

1.Increased Complexity

2The devices will have to carry higher values of peak current

(ii) **Describe working principle of MCT with the help of neat constructional diagram.** **4M**

Ans: **Constructional diagram:** **2M**



MOS Controlled Thyristor (MCT) Structure

Working: **2M**

MCT turn ON:

If the gate of the MCT is negative with respect to anode a p-channel is created in p-FET and p-channel ON FET causes the forward biasing of n-p-n transistor.(base drive to n-p-n transistor), the n-p-n transistor applies base drive to p-n-p transistor and regenerative action starts and the device is latched(turns ON).

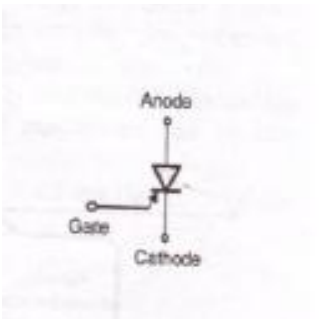
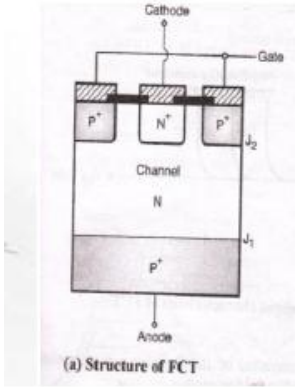
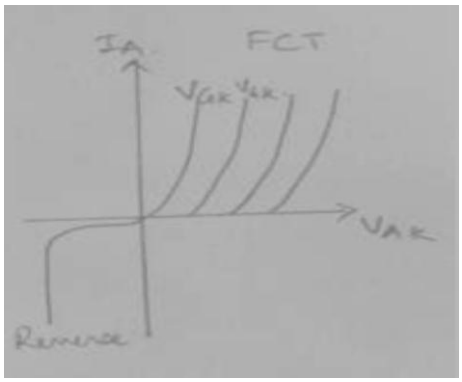
MCT turn OFF :

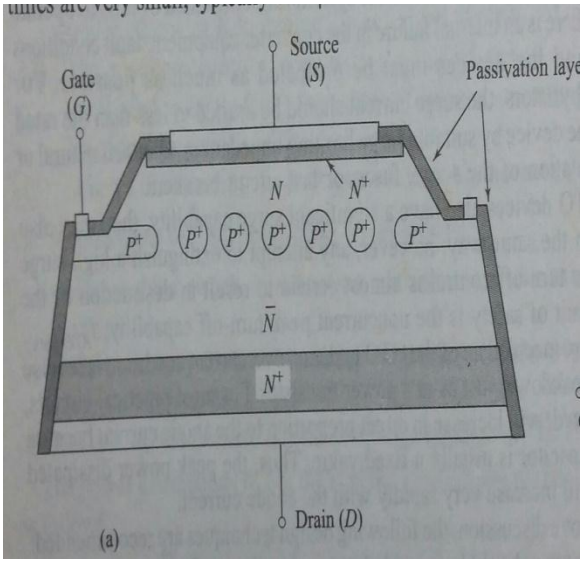
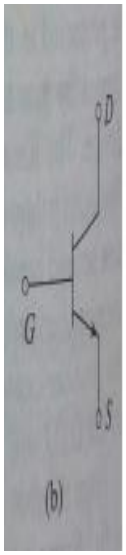
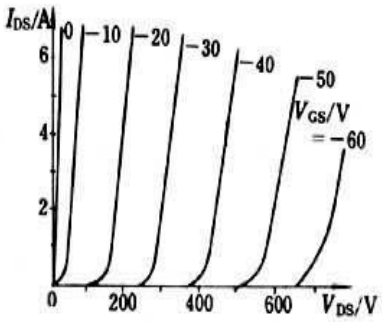
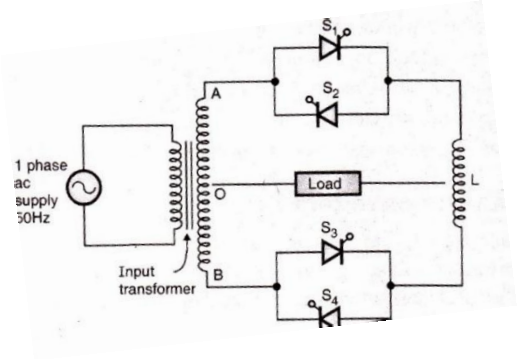
If the gate of MCT is positive with respect to anode, turn off the ON FET and N-channel is created in n-FET and n-channel FET turns ON which short circuit the base emitter junction of p-n-p transistor, this diverts the base drive of the transistor through OFF FET and breaks the regenerative process and the device will turn off.

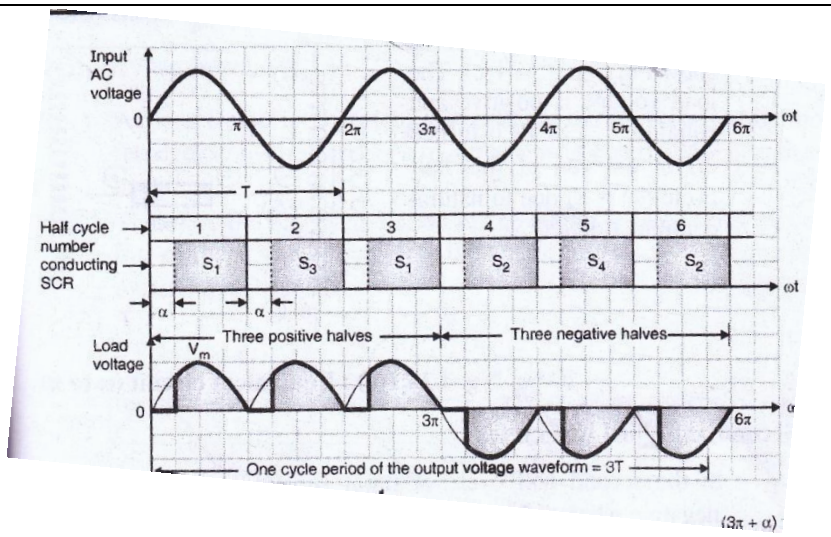
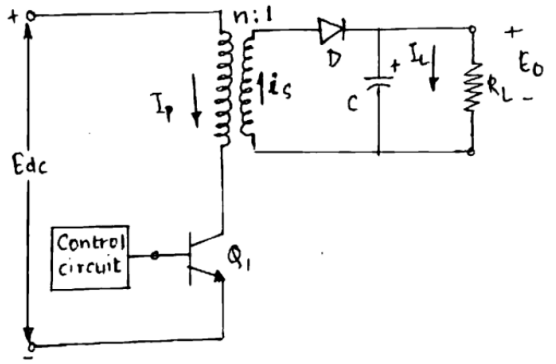
(iii) **Compare class A and class B choppers w.r.t. position of chopper switch, output voltage, quadrant of operation, application.** **4M**

Ans: **1M each**

Sr.No.	parameter	Class A chopper	Class B chopper
1	**Position of chopper switch**	In series with the load	In parallel with the load
2	**Output voltage**	positive	positive
3	**Quadrant of operation**	I st quadrant	IInd Quadrant
4	**Application**	Motoring action of DC motor	In Subway trains where regenerative braking Dc motors are used

	(iv)	**Define following battery parameters:** **(a) Backup time** **(b) Power rating** **(c) Transfer time** **(d) Typical value of each**	**4M**
	Ans:	• Back up time: It is the time period for which the ups system can supply power to the load after the mains failure has taken place. The back up time depends on the capacity of the battery and the efficiency of the inverter • Power rating of equipment is defined as the highest power input allowed to flow through particular equipment give marks if power rating is written in VA or in AH rating of battery. • Transfer time: In both on line as well as off line Ups system power is supplied by the mains when it is ON and it is supplied by the battery when the mains supply fail .The time taken by the Ups system to switch from mains to battery is known as transfer time. Ideally transfer time should be zero but practically it is about 4 to 5 msec. **<u>Typical value of each-</u>** **<u>(Note: This term can not be defined, but any of rating given below should be consider.)</u>** • Power rating -1KVA ,2KVA,5KVA • Back up time-30 Min to 4 Hours • Transfer time-4 to 5 msec. ***<u>Note: Give marks as per above definitions.</u>*** .	**1 M each**
	(B)	**Attempt any ONE of the following :**	**6M**
	(i)	**Draw symbol, construction and characteristics of SIT and FCT. Why they are called as normally ON devices?**	**6M**
	Ans:	**<u>FCT-</u>**   (a) Structure of FCT  **<u>SIT-</u>**	**2 ½ M**

		   As both the devices can be turned on easily with the application of gate pulse and are in On position initially. A negative gate voltage holds it off. So they are called normally ON devices.	**2 ½ M** **1M**
	(ii)	**With the help of neat diagram & waveforms, describe operation of midpoint cycloconverter.**	**6M**
	Ans:	**<u>Diagram :</u>**  **<u>Operation</u>** : First half cycle of input supply pont A is positive and B is negative , so SCR1 and SCR 4 are forward biased , out of which SCR1 is fired at an angle α For second and third half cycle of input supply ,SCR 2 and SCR 3 are forward biased ,out of which SCR 3 is forward biased and SCR 1 is turned on For fourth ,fifth and sixth input half cycle, SCR 2,4 and 2 are turned on to make the load voltage negative The output frequency is given as $F_{out} = 1/3\ f_{in}$ **<u>Waveform :</u>**	**2M** **2M**

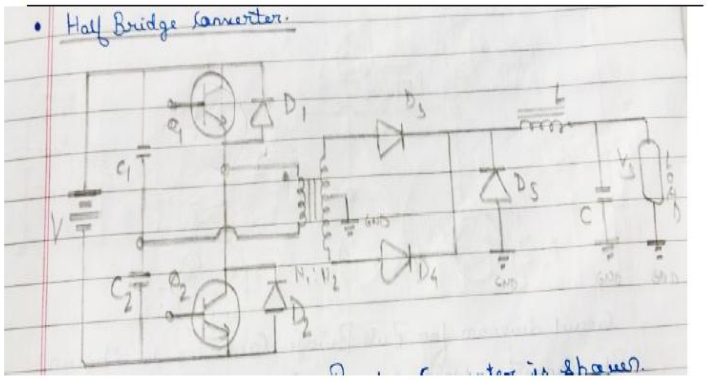
			**2M**
Q.5		**Attempt any TWO of the following :**	**16M**
	(a)	**Describe operation of isolated SMPS with the help of neat diagram. State any two advantages & disadvantages of it.**	**8M**
	Ans:	***Note: Any one type is to be considered*** **Fly-back converter-** **Circuit Diagram:**  fig: flyback converter **Explanation:** **Mode I :** When transistor Q1 is ON at t=0, primary current starts to build up in the primary winding, storing energy. Due to the opposite primary arrangement between the input & output windings of the transformer choke, there is no energy transferred to the load since diode D is reversed biased. Transistor Q1 is turned off abruptly at instant t=t1. The equivalent circuit for this mode is shown in figure **Mode II:** When the transistor is turned off at t=t1, the polarity of the windings reverses due to the collapsing magnetic field. Now, diode D is conducting, charging the output capacitor C and delivering current IL to load .The voltage across Q1 is the sum of input supply voltage (Edc) and the self- induced voltage across the primary winding (Ldi/dt) , therefore it is higher than the supply voltage (Edc). **Mode III:** In this mode transistor and diode both are in the off state. Therefore, primary and	**(Circuit Diagram:2 M,Explanation:2M)**

secondary currents are zero. As there is no voltage drop across primary winding of the transformer, the voltage across the transistor Q1 is equal to the dc supply voltage(Edc). The secondary voltage is zero. The one cycle operation completes in this mode and repeats itself.

OR

Half bridge converter:

Circuit diagram:



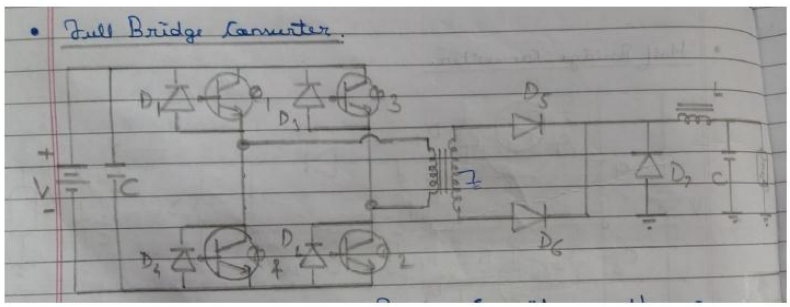
Explanation:

It is a D.C to A.C converter. This output is rectified and filtered by the LC filter. When Q1 is turned ON, voltage across C1 i.e. V/2 appears across the primary of the transformer. D3 is forward biased and D4 is reverse biased. When Q2 is turned ON, voltage across C2 i.e. V/2 appears across the primary of the transformer. D4 is forward biased and D3 is reverse biased.

OR

Full bridge converter:

Circuit Diagram:



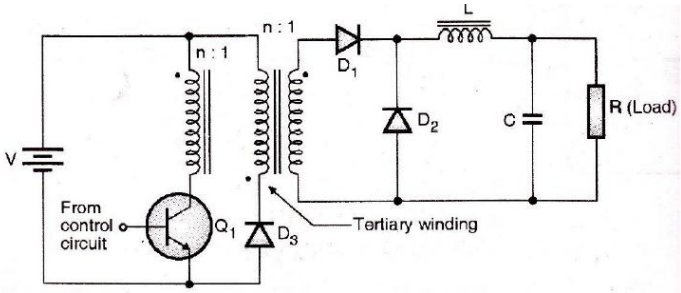
Explanation:

It is a D.C to A.C converter. This output is rectified and filtered by the LC filter. When Q1 and Q2 are turned ON simultaneously, voltage appears across the primary of the transformer. D5 is forward biased and D6 is reverse biased. When Q3 and Q4 are turned ON, voltage appears across the primary of the transformer. D6 is forward biased and D5 is reverse biased.

OR

Forward Converter:-

Circuit diagram:



Operation:-

If you compare the circuit diagram of forward converter with that of a fly-back converter you will find that the configurations are exactly identical to each other except for the winding directions of primary and secondary windings(see the dots on these windings).The operation of the circuit can be explained by dividing it into two modes.

1. Mode I (Q1 ON) :

1. As soon as Q1 is turned on, the supply voltage "V" is applied across the primary winding of the transformer.
2. Due to this constant voltage, the primary current increases at a constant rate.
3. Due to the winding polarity as shown in fig., the induced voltage in the secondary winding will forward bias diode D1 and the secondary current starts flowing.

2. Mode II (Q1 OFF):

1. When the power switch Q1 is turned off, the primary voltage will change its polarity as shown in fig.
2. The secondary voltage also will change its polarity.
3. Diode D1 is reverse biased and D2 is forward biased due to the induced voltage in the filter inductance and the current flows through the load as shown in fig.

Advantages of isolated SMPS: (Any two)

1. Electrical isolation is provided between the load and source
2. Good regulation
3 possibility to get multiple connections

Disadvantages of isolated SMPS: (Any two)

1. Complicated circuit
2. High cost

2M

2M

	(b)	**State the working principle of resistance welding. Draw block diagram of capacitor energy storage welding waveforms. State advantages & disadvantages**	**8M**
	Ans:	**Resistance Welding:**	**Diagram optional**

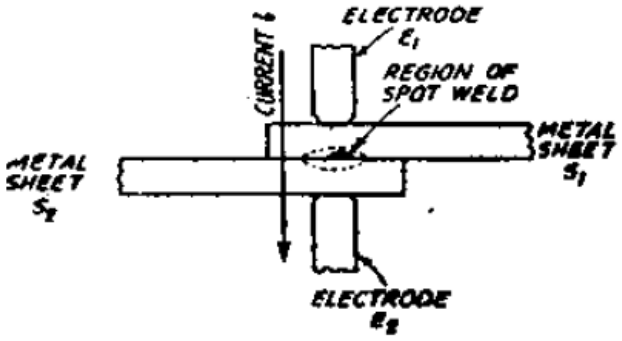


Fig. Resistance Welding

2M

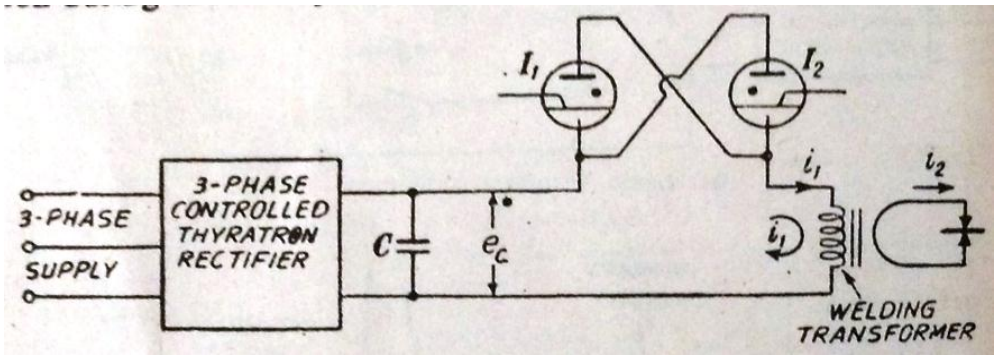
Principle:

1. The operating principle is based on heating effect of current. Heat is produced due to the resistance offered by the metals sheets to the current passing through them.
2. Heat produced is utilized for welding and Heat = $\int i^2R\,t$
3. The line contactor is basically a controlled switch which connects the ac mains voltage across the primary winding of the welding transformer.
4. The welding transformer is a step down transformer which supplies a reduced voltage on the secondary side but increases the secondary current which is the welding current.
5. The current is usually in the range of several hundred to several thousands of amperes, depending on the nature of current.

2M

Capacitor Energy Storage Welding :

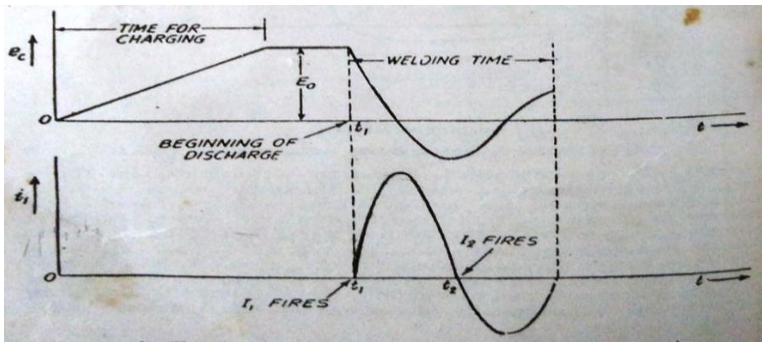
Block Diagram:

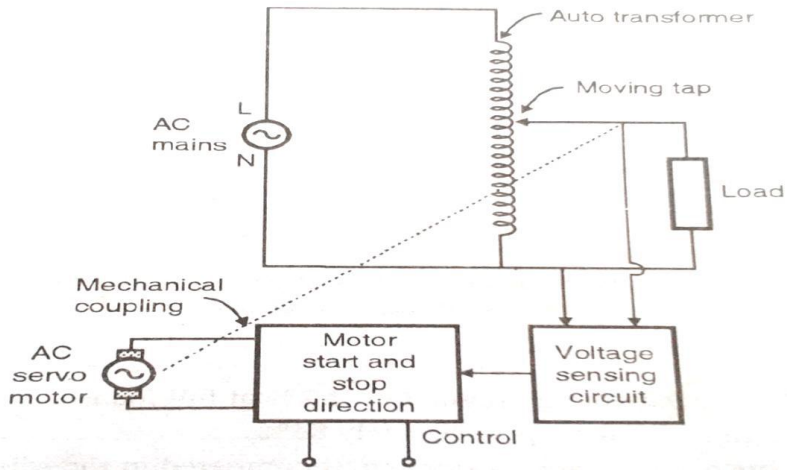


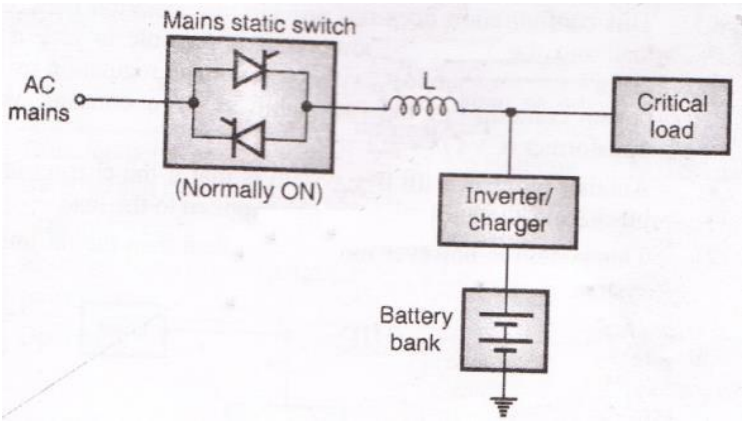
2M

Fig. Basic Circuit of Capacitor Energy Storage Welding

Waveform:



		Advantages: 1. Simple circuit 2. Does not cause voltage dip at the time of welding. **Disadvantages:** 1. Large value capacitor is required. 2. 3 phase rectifier is used.	**1M** **1M**
	(c)	**Explain operating principle of servo type AC voltage stabilizer. Give any two advantages, disadvantages & applications.**	**8M**
	Ans:	**Servo type AC voltage stabilizer:** **Diagram:**  **Explanation:** Above figure shows the servo-type stabilizer. As seen from the figure it uses an ac servomotor which is mechanically coupled to the moving tap of an autotransformer. The sensing circuit will sense the load voltage ,if it is found to be less than or greater than the normal voltage i.e 230v, it will rotate the ac servomotor in either clockwise or anticlockwise direction. This will rotate the moving tap of the autotransformer and the necessary corrective action is completed. **Advantages**:- 1. Smooth step less variation in the output voltage. 2. Good voltage regulation 3. Output voltage waveform is undistorted **Disadvantages**:- 1. Due to the use of autotransformer and ac servomotor circuit is costly 2. It is not very fast in action **Application:-** 1. Mostly for computers. 2. CNC machines	**2M** **2 M** **1½ M** **1½ M** **1M**
Q.6		**Attempt any FOUR of the following:**	**16M**
	(a)	**Describe operation of line interactive UPS with help of block diagram**	**4M**
	Ans:	**Block diagram of LINE Interactive UPS:-**	**2 M**



Working:

Only one mains static switch is present which is normally on.

Mode 1:

The static switch is closed and the load gets connected directly to the ac mains. The inverter /charger block acts as a charger and charges the battery.

Mode 2:

When the mains fail the static switch opens, the inverter /charger block acts as an inverter and the battery supplies power to the load through the inverter**.**

2M

(b) **What are different types of Resistance welding? Draw neat sketch of each type.** **4M**

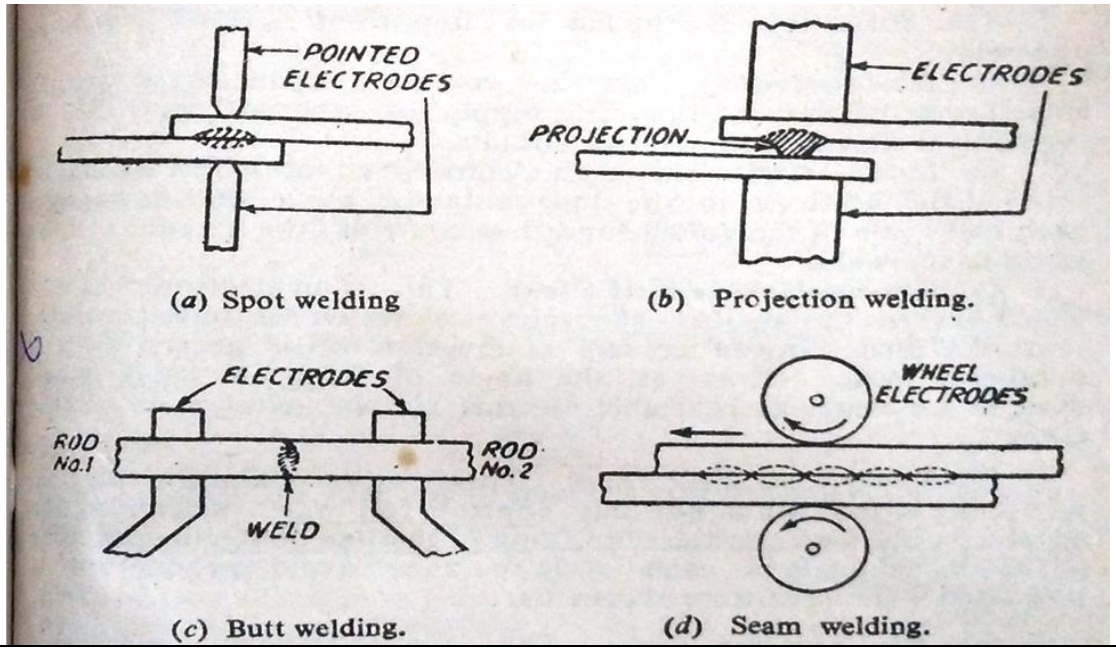
Ans:

Types of resistance welding: **2 M**

1. Butt welding
2. Spot welding
3. Projection welding
4. Seam weldin

Diagram:

½ M for each Diagram



(c) **Compare online and offline UPS w.r.t. output voltage waveform, transfer time, static switch & applications.** **4M**

Ans: **4M**

Sr. No.	Parameter	ON Line UPS	OFF Line UPS
1	Output Voltage waveform	Sinusoidal	Quasi Square
2	Transfer Time	0	<5ms
3	MainsStatic Switch UPS static switch	Normally OFF Normally ON	Normally ON Normally OFF
4	Application	Medical Equipment or for critical load	Computer and Electrical Equipment like Lights and fans.Or for general purpose load

(d) **Draw circuit diagram of McMurray full bridge inverter. Draw voltage & current waveforms across commutating capacitor.** **4M**

Ans: **3M**

Mc- Murray Bed ford full bridge inverter

Note:Give marsks for Mc Murray full bridge (auxiliary commutated) inverter also with waveforms.

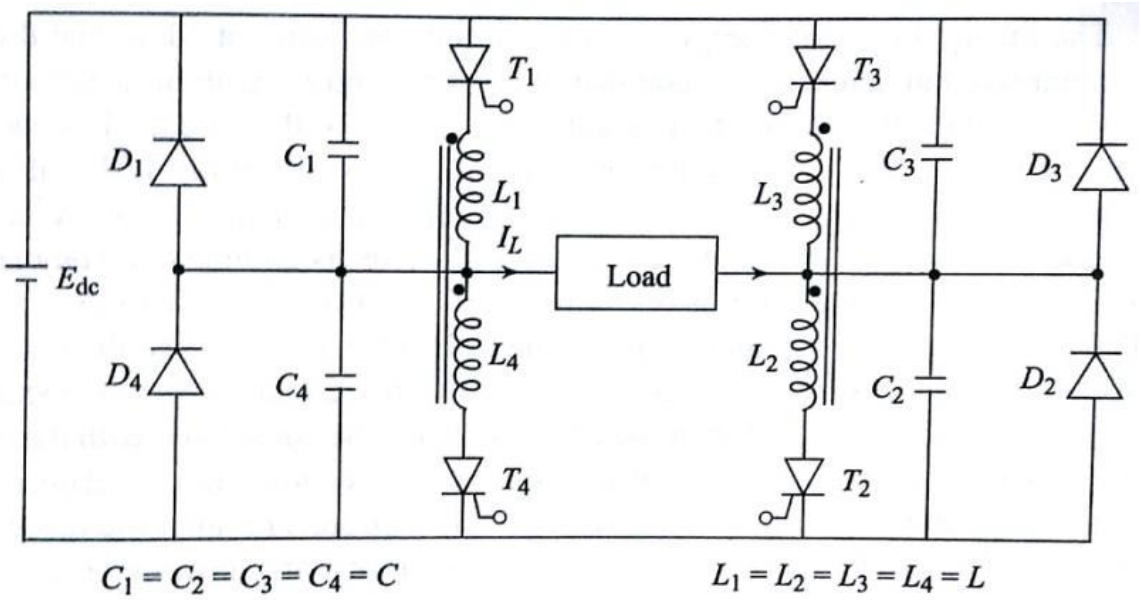
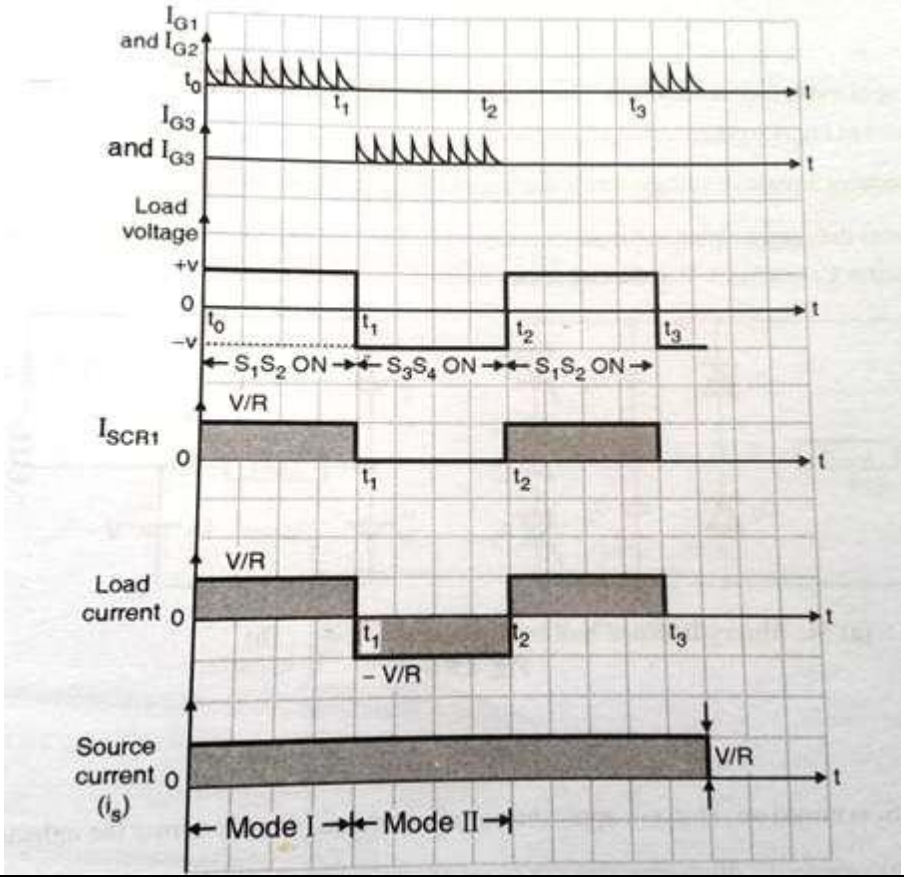
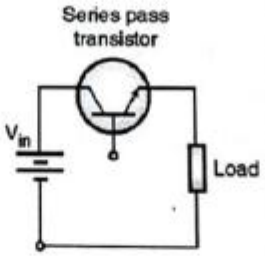
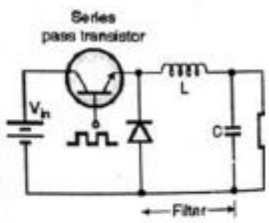


Fig. 9.52 *McMurray–Bedford full-bridge inverter*

		Mc- Murray Bed ford full bridge inverter: 	**1M**
(e)	**What is SMPS? How is it different from linear power supplies? State any two advantages of SMPS over linear power supplies.**		**4M**
Ans:	**SMPS is Switch Mode Power Supply.** It is an electronic circuit used to control and stabilise the output voltage. It converts power using switching devices that are turned on and off at high frequencies. It also uses storage components such as inductors or capacitors to supply power when the switching device is in its non-conduction state. **SMPS is different from Linear Power supplies in the form of following points. (Consider any two points)**		**1M** 1M **2M** 2M

Sr. No.	Parameter	Linear regulator	Switched mode regulator
1.	Configuration/Circuit diagram	(I-773) 	(I-774) 
2.	Region of operation of the power transistor	Active region	Saturation or cut-off
3.	Switching	No switching	Transistor acts as a switch
4.	Complexity	Less	High
5.	Efficiency	Low (40%)	High (90%)
6.	Switching frequency of the power transistor	Very low	Very high (25 kHz)
7.	Switching losses	Zero	Very high
8.	RFI/EMI	Absent	Very high
9.	Component stress	High	Very high
10.	Regulation	Excellent	Good
11.	Cost	Lowest	Moderate
12.	Size/weight	Large/bulky	Small/light weight
13.	Power handling capacity	Low	High

1M

<u>Advantages of SMPS over Linear Power Supplies</u>:
(Any two points shall be considered)
1. Electrical isolation is provided between the load and source
2.Good regulation
3. high power handling capacity
4. switching frequency is very high
5. less losses and high efficiency.