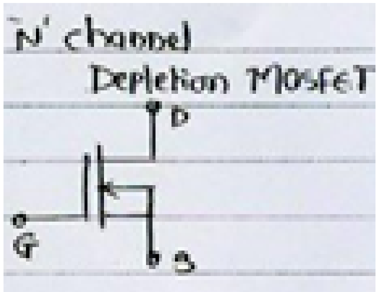
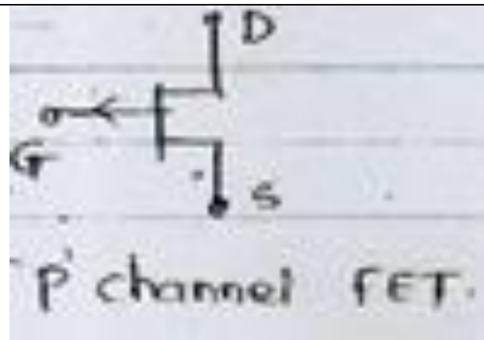
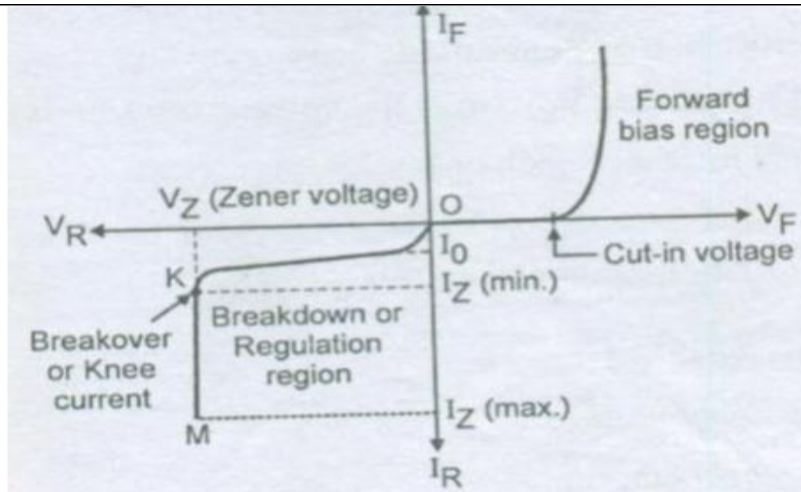
WINTER– 18 EXAMINATION

Subject Name: Basic Electronics <u>**Model Answer**</u> **Subject Code:** 17213

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in themodel answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may tryto assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given moreImportance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in thefigure. 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 constantvalues 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.	Answers	Marking Scheme
1	**(A)**	**Attempt any ten of the following:**	**20- Total Marks**
	(a)	**Compare active and passive component(any two points)**	**2M**
	Ans:	<table><tr><th>Parameter</th><th>Active component</th><th>Passive component</th></tr><tr><td>Definition</td><td>component which introduce gain in the circuit are called active components.</td><td>Components which do not introduce any gain in the circuit.</td></tr><tr><td>Example</td><td>Diode, transistor, FET</td><td>Resistor, capacitor& inductor</td></tr><tr><td>Direction</td><td>They are unidirectional</td><td>They are bidirectional</td></tr></table>	**1M each for correct comparison point (Any 2 points)**
	(b)	**Draw the symbol of N-channel MOSFET and P- channel JFET.**	**2M**

	Ans:	 	**1M each for correct symbol**
	(c)	**Draw V-I characteristics of zener diode.**	**2M**
	Ans:		**2M for correct characteristics**
	(d)	**List any two types of coupling used in amplifier.**	**2M**
	Ans:	1. Resistance – capacitance (RC) coupling. 2. Inductance coupling. 3. Transformer coupling (TC) 4. Direct coupling (D.C.)	**1M each for coupling**
	e)	**Give any two applications of P-N junction diode.**	**2M**
	Ans:	1.It is used as rectifier in DC power supply 2.It is used as free wheel diode across relay or inductive load 3.It is used as switch in logic circuits used in computers 4.It is used as detector in demodulation circuits of communication receiver	**1M each** **(Any 2 Applications)**

	f)	**Write any two advantages and disadvantages of ICs.**	**2M**
	Ans:	**Advantages of ICs:** 1.The physical size of an IC is extremely small (generally thousand times smaller) than that of discrete circuits. 2. The weight of an IC is very less as compared to that of equivalent discrete circuits. 3. The reduction in power consumption is achieved due to extremely small size of IC. 4. Interconnection errors are non-existent in practice **Disadvantages of ICs:** 1. It is not possible to directly fabricate inductors. 2. The initial cost to be incurred is high 3. Power dissipation is limited. 4. ICs are very delicate and need extra care while handling	**1 Marks each for any 1 advantage & any 1 Disadvantage**
	g)	**List any two types of filter.**	**2M**
	Ans:	Important types of filters are as follows: 1. Shunt capacitor filter 2. Series inductor filter 3. LC filter 4. π type filter or CLC filter 5. CRC filter.	**1M each for any 2 types**
	h)	**Differentiate between N-channel and P-channel J-FET.**	**2M**
	Ans:	(see table below)	**1M each for any two correct comparison point**

N-Channel JFET	P-Channel JFET
1.The current conduction takes place due to electrons	1.The current conduction takes place due to holes.
2.Its switching speed and cut off frequency is high.	2.Its switching speed and cut off frequency is comparatively low.
3.Its transconductance is high	3.Its transconductance is low

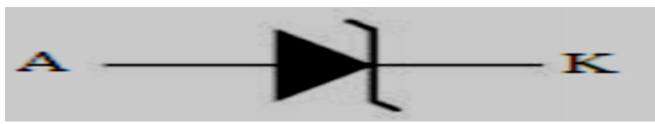
WINTER– 18 EXAMINATION

Subject Name: Basic Electronics **Model Answer** **Subject Code:** 17213

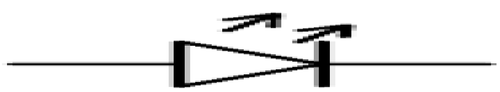
4.It is less noisy	4.It is comparatively more noisy
5.It is most widely used in circuit applications	5.It is comparatively less used in circuit applications

i) **Draw the symbol of zener diode and LED.** **2M**

Ans: **Zener diode symbol** **1M each**



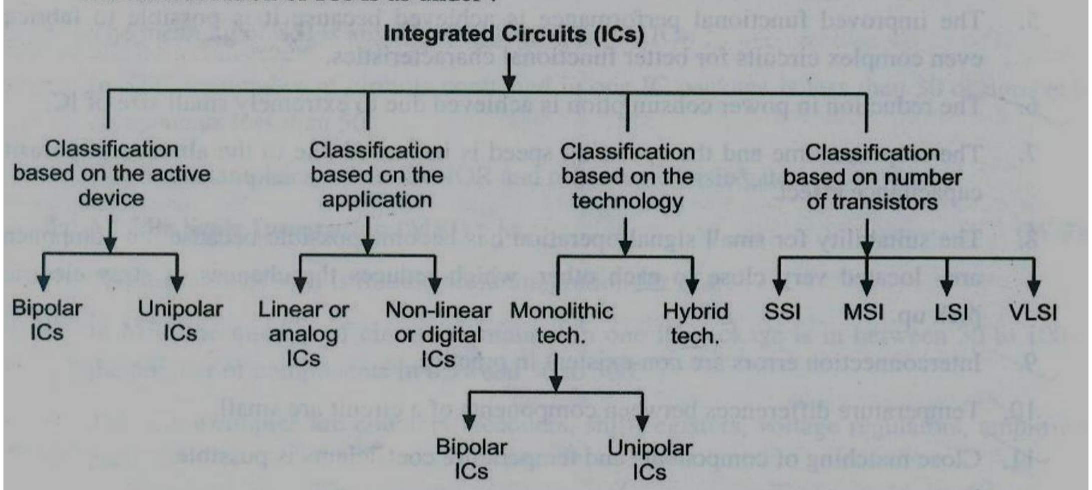
Symbol of LED



j) **Give the classification of ICs.** **2M**

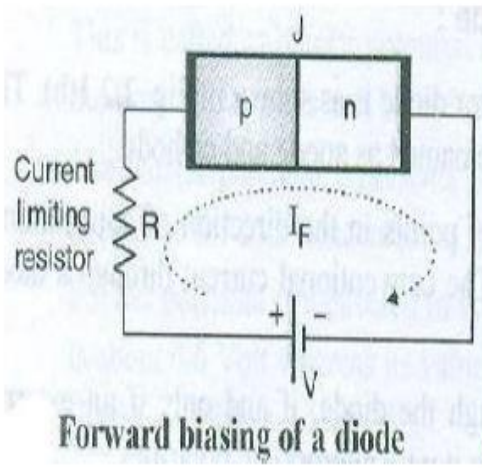
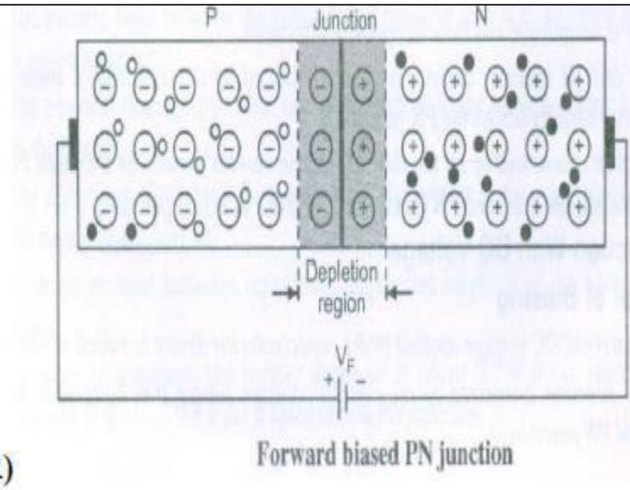
Ans: **2M for correct classification**

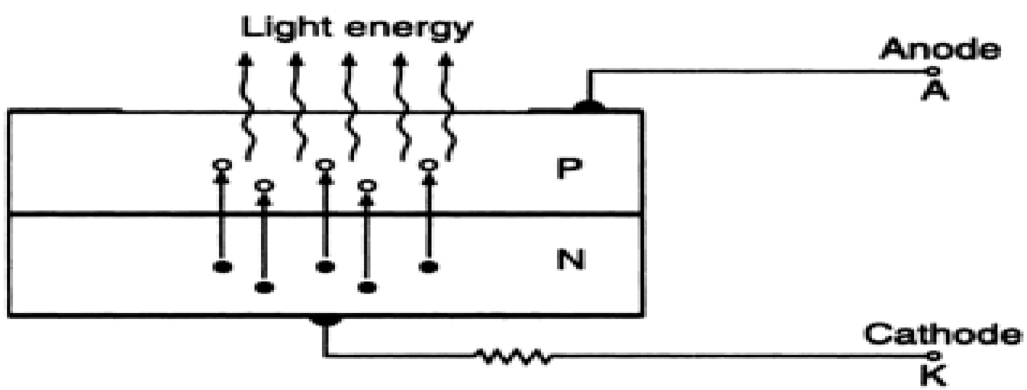
The classification of ICs is as under :



Classification of integrated circuits (ICs)

k) **Draw circuit diagram of P-N junction diode in forward bias.** **2M**

	Ans:	Forward biasing of a diode **(OR)** Forward biased PN junction	**2M for correct circuit diagram**
	l)	**Define resistance with its unit.**	**2M**
	Ans:	Resistance is a measure of the degree to which a substance impedes the flow of electric current induced by a voltage. Or Resistance is the opposition to current flow in an electrical circuit. Unit is ohm.(Ω)	**1M for definition & 1M for unit**
Q. No.	Sub Q. N.	Answers	Marking Scheme
2		**Attempt any four of the following::**	**16- Total Marks**
	a)	**Enlist any four applications of electronics.**	**4M**
	Ans:	**Applications of electronics are as follows:** a) Communication and entertainment: Telephony, Telegraphy b) Instrumentation & control: CRO, function generator, power supply, digital multimeter, SCR to control motor speed, control circuits used electronic components etc.	**1M each for any 4 correct applications**

		c) Defence: Radar, aeroplanes, ships, underwater robots etc. d) Education: computer, LCD, printer etc. e) Machine: Many medical equipments like EEG, MRI, ECG, X-RAY, sonography machines etc	
	b)	**Explain working principle of LED.**	**4M**
		Operating principle of LED  • The lighting emitting diode is a p-n junction diode. It is a specially doped diode and made up of a special type of semiconducting materials like Gallium Phosphide(GaP), Gallium Arsenide Phosphide(GaAsP) and Gallium Nitride(GaN). • The working principle of the light emitting diode is based on the quantum theory. • The quantum theory says that when the electron comes down from the higher energy level to the lower energy level then, the energy emits from the photon. • When the LED is forward biased, the electrons in the n-region will cross the junction and recombine with the holes in the p-type material. • These free electrons reside in the conduction band and hence at a higher energy level than the holes in the valance band. • When the recombination takes place, these electrons return to the valance band which is at lower energy level than the conduction band. • While returning , the recombining electrons give away the excess energy in the form	**2M for diagram & 2M for explanation**

of light.

- Color of emitted light depends on which material is used to manufacture the diode.

c) **Compare CE, CB, CC (any four points)** **4M**

Ans:

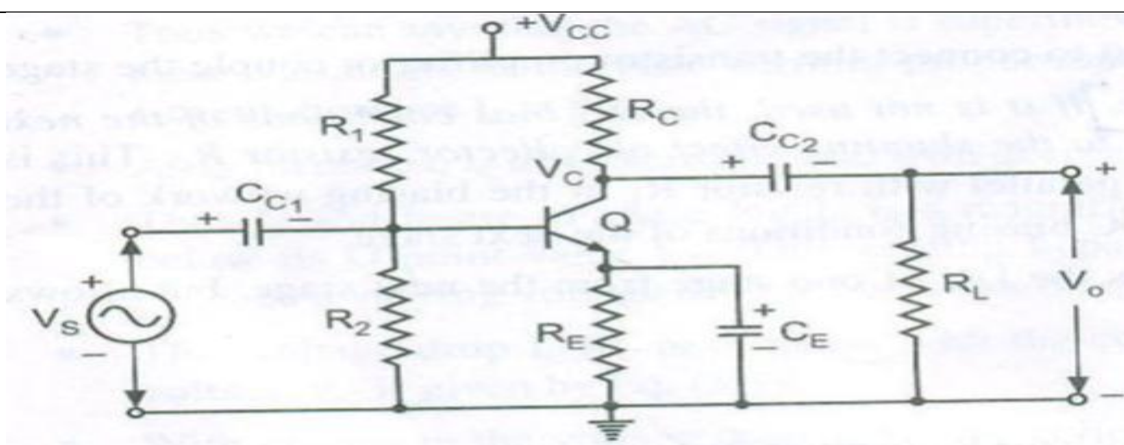
characteristics	**CE**	**CB**	**CC**
Input impedance	Medium (about 800Ω)	Low (about 100Ω)	Very high (about 750KΩ)
Output impedance	High (about 50KΩ)	Very high (about 500KΩ)	Low (about 50Ω)
3.voltage gain	Highest (about 500)	High (about 150)	Low (less than unity)
4.current gain	High $\beta = \frac{IC}{IB}$	Less than unity $\alpha = \frac{IC}{IE}$	Highest $\gamma = \frac{IE}{IB}$
5.Applications	AF Applications	HF Applications	Impedance matching

1M each for any 4 comparison.

Marks should be given if only degree (high, low) is written and the values not written

d) **Explain working of single stage CE amplifier with circuit diagram.** **4M**

Ans:



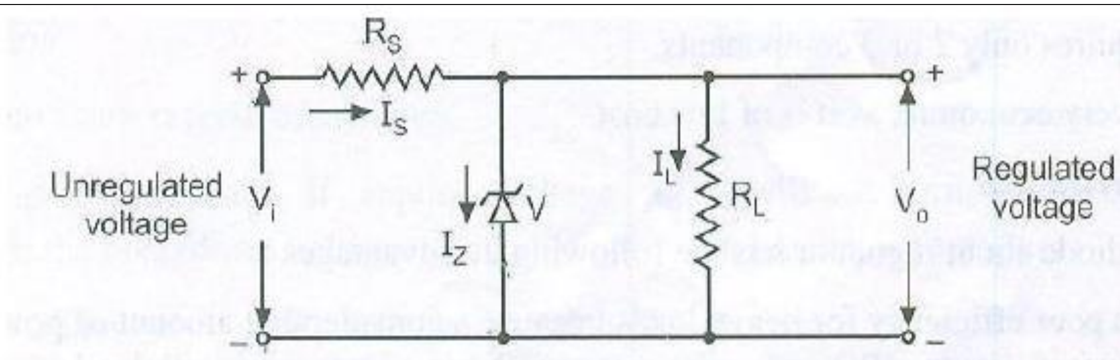
a) R_1 and R_2 provides required forward bias for BE region, by divider bias method.

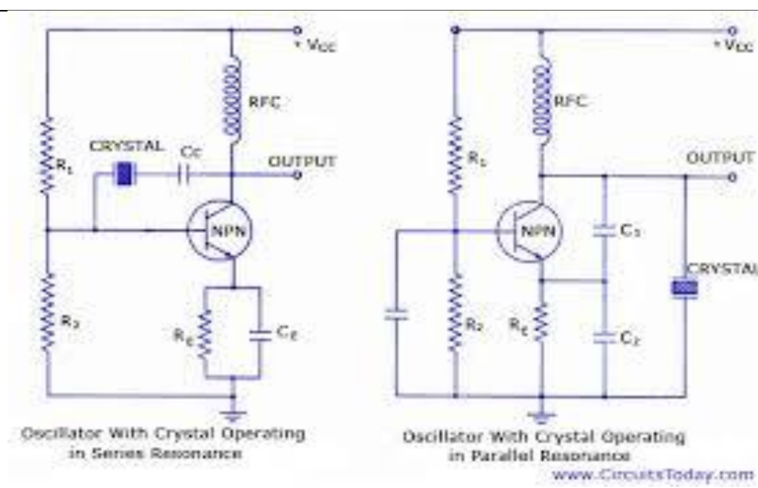
b) R_C provides V_{CC}- I_CRc, reverse bias to collector.

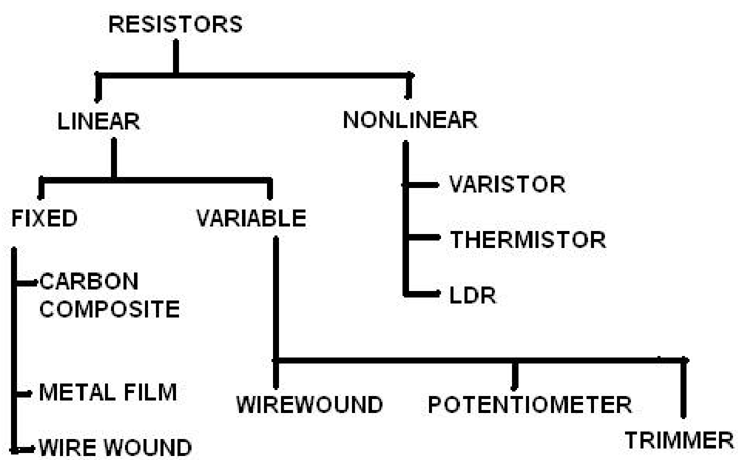
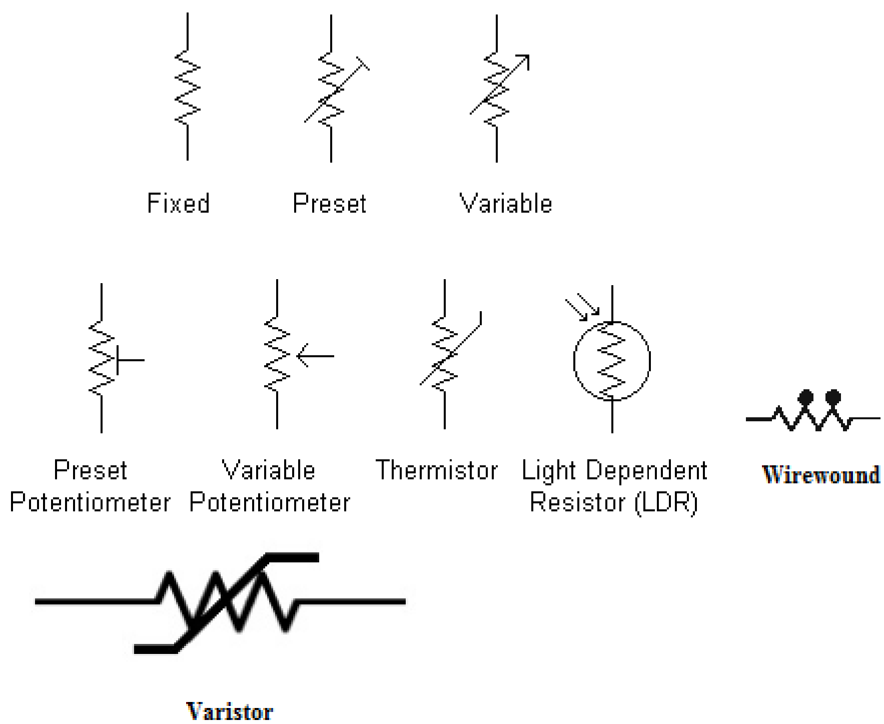
2M for diagram & 2M for explanation

WINTER– 18 EXAMINATION

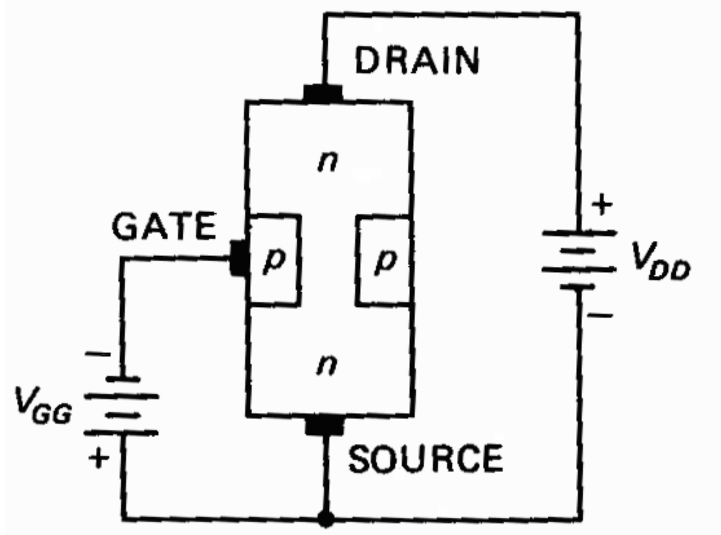
Subject Name: Basic Electronics **Model Answer** **Subject Code:** 17213

		c) R_E works as stabilizer and avoids thermal runaway. d) C_C are the capacitor that passes the AC from one side to the other and blocks the DC. So it is also called as Blocking Capacitor e) C_E is the Bypass Capacitor that bypasses the AC current from the Emitter to the ground. f) The Input circuit is forward biased and has low resistance. So a small change in the input signal causes change in input current and subsequently larger change In the output current I_C. So the output voltage across load resistance I_CR_L is large ie. Output is amplified g) The output voltage is 180^0 out of phase with the input. As the input voltage increases, I_B increases, so I_C also increases. As a result, voltage $V_{CE} = V_{CC} – I_CR_C$ decreases. Similarly as input decreases, output voltage increase. So the output voltage is inverted.	
	e)	**Explain zener diode as a voltage regulator.**	**4M**
	Ans:	 **Zener regulator** **Operating Principle** For proper operation, the input voltage Vi must be greater than the Zener voltage Vz. This ensures that the Zener diode operates in the reverse breakdown condition. The unregulated input voltage Vi is applied to the Zener diode. Suppose this input voltage exceeds the Zener voltage. This voltage operates the Zener diode in reverse breakdown region and maintains a constant voltage, i.e. Vz = Vo across the load inspite of input AC voltage fluctuations or load current variations. The input current is given by, $$I_S = \frac{V_i - V_Z}{R_S} = \frac{V_i - V_O}{R_S}$$ We know that the input current I_S is the sum of Zener current Iz and load current I_L	**2M for diagram & 2M for explanation**

		$$\text{Therefore, } I_S = I_Z + I_L$$ As the load current increase, the Zener current decreases so that the input current remains constant. According to Kirchhoff's voltage law, the output voltage is given by, $$V_o = V_i - I_s \cdot R_s$$ As the input current is constant, the output voltage remains constant (i.e. unaltered or unchanged). The reverse would be true, if theload current decreases. This circuit is also correct for the changes in input voltage. As the input voltage increases, more Zener current will flow through the Zener diode. This increases the input voltage Is, and also the voltage drop across the resistor Rs, but the load voltage Vo would remain constant. The reverse would be true, if the decrease in input voltage is not below Zener voltage. Thus, a Zener diode acts as a voltage regulator and the fixed voltage is maintained across the load resistor RL	
	f)	**Draw the circuit diagram of crystal oscillator and give any two application.**	**4M**
	Ans:	 **Applications of Crystal Oscillator:** 1)The crystal oscillators are used in the frequency synthesizers. 2)It is used in special types of receivers. 3)It is used in radio and TV transmitters. 4)It is used as a crystal clock in microprocessors.	**2M for circuit diagram & 2M for applications**

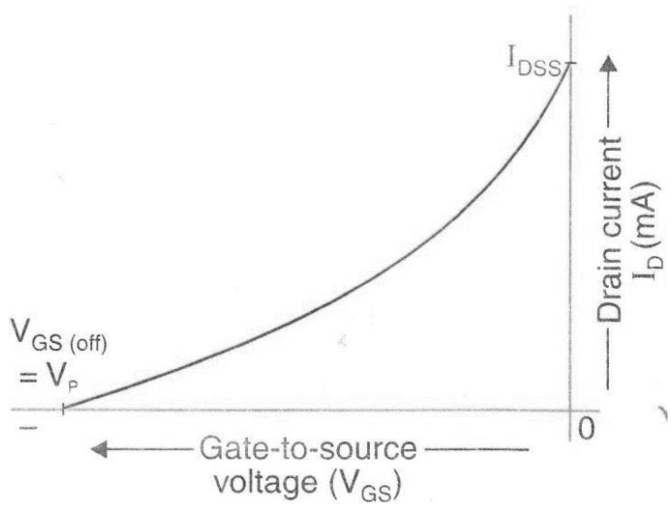
Q. No.	Sub Q. N.	Answers	Marking Scheme
3		**Attempt any four of the following::**	**16- Total Marks**
	a)	**Give classification of resistors and draw symbol of any two.**	**4M**
	Ans:	 	**Classification-3M** **Any two symbol-1/2M for each**

	b)	**Explain zener breakdown and avalanche breakdown.**	**4M**
	Ans:	The **Zener Breakdown and Avalanche Breakdown** are two different mechanisms by which a PN junction breaks. The Zener and Avalanche breakdown both occur in diode under reverse bias. The avalanche breakdown occurs because of the ionization of electrons and hole pairs whereas the Zener diode occurs because of heavy doping. **Zener Breakdown:** The phenomenon of the Zener breakdown occurs in the very thin depletion region. When reverse bias is increased, the electric field across the thin depletion region increases. This high electric field breaks the covalent bonds and a large number of minority carriers are generated. So a large reverse current flows and causes breakdown. This process is known as the Zener breakdown. **Avalanche Breakdown**: As the reverse bias increases, the electrical field across the depletion region increases. When the high electric field exists across the depletion, the velocity of minority charge carrier crossing the depletion region increases. These carriers collide with the atoms of the crystal. Because of the violent collision, the charge carrier takes out the electrons from the atom. These electrons collide with the other atoms of the crystals and release more electrons. The process is continuous, and the electric field becomes so much higher that a large reverse current starts flowing in the PN junction and causes breakdown. The process is known as the Avalanche breakdown.	**Zener Breakdown -2M** **Avalanche breakdown -2M**
	c)	**Explain N-channel J-FET with its transfer characteristics.**	**4M**
	Ans:	**Working of Channel JFET:**	



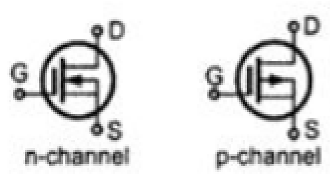
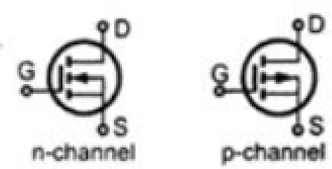
Working:

1. The application of negative gate voltage and positive drain voltage with respect to source, reverse biases the gate- source junction of an N-channel JFET.
2. When a voltage is applied between the drain & source with dc supply voltage (VDD), the electrons flows from source to drain through the narrow channel existing between the depletion regions. This constitutes the drain current (ID) & its conventional direction is from drain to source. The value of drain current is maximum, when no external voltage is applied between the gate & source & is designated by the symbol IDSS.
3. When VGG is increased, the reverse bias voltage across gate-source junction is increased. As a result of this depletion regions are widened. This reduces the effective width of the channel & therefore controls the flow of drain current through the channel.
4. When gate to source voltage (VGS) is increased further, a stage is reached at which both depletion regions touch each other.
5. At this value of VGS, channel is completely blocked or pinched off & drain current is reduced to zero. The value of VGS at which drain current becomes zero is called pinch off voltage designated by the symbol VP or VGS(OFF) . The value of VP is negative for N-channel JFET.



d)	**Compare D-MOSFET and E-MOSFET.**	**4M**

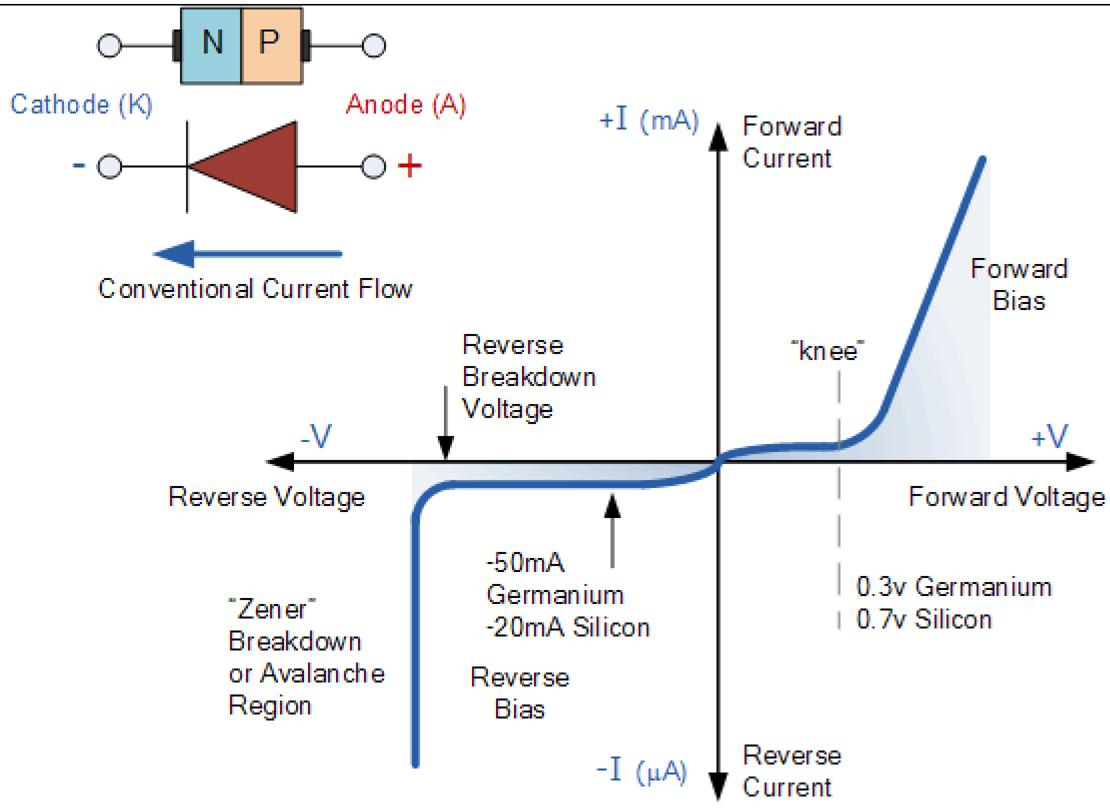
Ans:

Parameter	**D-MOSFET**	**E-MOSFET**
Symbol		
Channel	Channel exists permanently.	Channel is physically absent. It is induced after application of gate voltage above the threshold value.
Conduction mode	Operate in depletion as well as enhancement mode	Operated in enhancement mode only.
Current Flow	Drain current flows on application of drain to source at Vgs=0v	Practically no current flows on application of drain to source at Vgs=0v. Current flow only when Vgs is above threshold level

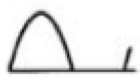
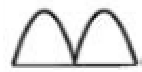
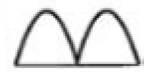
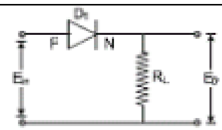
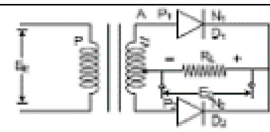
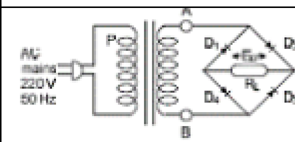
Any 4 point- 1M each

	e)	**Derive the relation between α and β.**	**4M**
	Ans:	We know that, IE = IB + IC ---1M Dividing the above equation on both sides by IC, we get IE/IC = IB/IC + 1 ---1M Since IC/IE = α and IB/IC = β --1M So, IE/IC = 1/ α and IC/IB = 1/β Therefore, 1/ α = (1/β) + 1 1/ α = (1+β) / β Therefore, α = β /(1+β) ---1M OR The above expression may be written as α (1+β) = β α + α β = β α = β – αβ = β (1 – α) Therefore, β = α /(1 – α)	**Correct derivation 4 M**
	f)	**State the need of oscillator with its two applications.**	**4M**
	Ans:	**Need:** Any circuit that generates an alternating voltage is called an oscillator. To generate ac Voltage, it takes energy from the dc source. 1. In some applications voltages of low frequency are required where as in other application voltages of higher frequency are required.	**Need-2M** **Any two Suitable application-1M each**

		2. In industry, it is frequently necessary to heat different kind of materials. 3. Oscillators are also needed in testing laboratories. **Application:** • In radio Transmitter and receiver. • It is used in the radio and mobile communications. • It is used to generate clock in digital systems. • It is used as sweep circuits in TV and CRO.	
Q. No.	Sub Q. N.	Answers	Marking Scheme
4		**Attempt any four of the following::**	**16- Total Marks**
	(a)	**Draw forward and reverse characteristics of P-N junction diode.**	**4M**

	Ans:		**correct forward and reverse characteristic- 2M each**
	(b)	**Compare Half Wave Rectifier and Full Wave Rectifier.**	**4M**
	Ans:	(see table below)	**Any 4 point- 1M each**

Parameter	**Half wave**	**Full wave center Tap**	**Full wave Bridge**
No. of Diode	**1**	**2**	**4**
Ripple Factor	**1.21 or 121%**	**0.48 or 48%**	**0.48 or 48%**
DC voltage V_{DC}	$\frac{Vm}{\pi}$	$\frac{2Vm}{\pi}$	$\frac{2Vm}{\pi}$
Ripple frequency	**Supply freq. f**	**2f**	**2f**
Maximum Rectification Efficiency	**40.6%**	**81.2%**	**81.2%**
Transformer Utilization	**28.7%**	**69.3%**	**81.2%**

Factor(TUF)			
PIV rating of the diode	**Vm**	**2Vm**	**Vm**
Output waveform			
Circuit Diagram			

(c) Define: **4M**

i) **Q point**
ii) **DC loadline**
iii) **Need of biasing**
iv) **Current gain**

Ans:

i) **Q point:** It is the point on the load line which represents the dc current through a transistor (I_{CQ}) and the voltage across it (V_{CEQ}), when no ac signal is applied.

ii) **DC load line:** The DC Load Line is the locus of all possible operating point.

Or

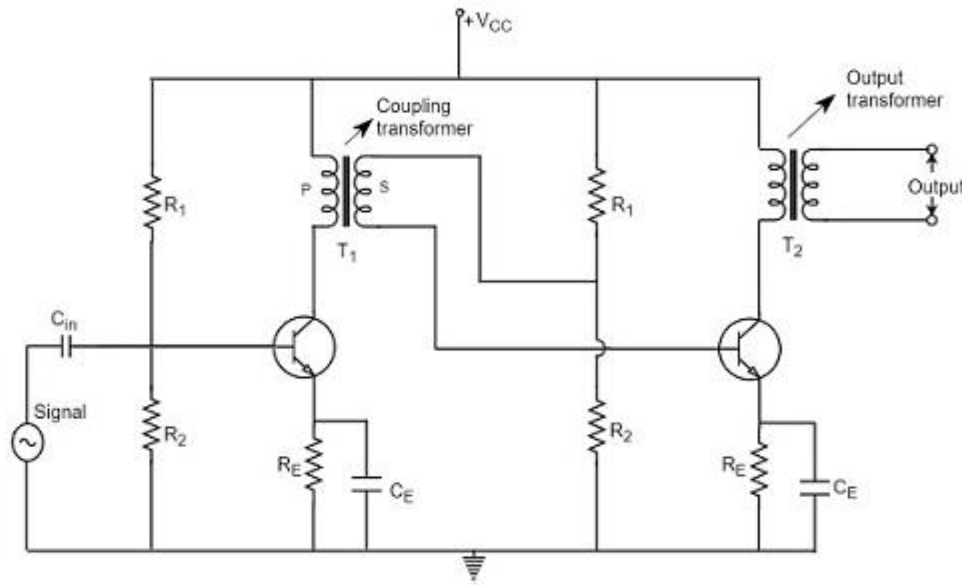
The DC load represents the desirable combinations of the collector current and the collector-emitter voltage. It is drawn when no signal is given to the input, and the transistor becomes bias.

iii) **Need of biasing:** As transistor can operate in cutoff, active and saturation. To operate the transistor in respective region, depending on the application for which the transistor is used, it should be correctly biased. So biasing decides the position of operation point on the load line so that the operating region is as desired.

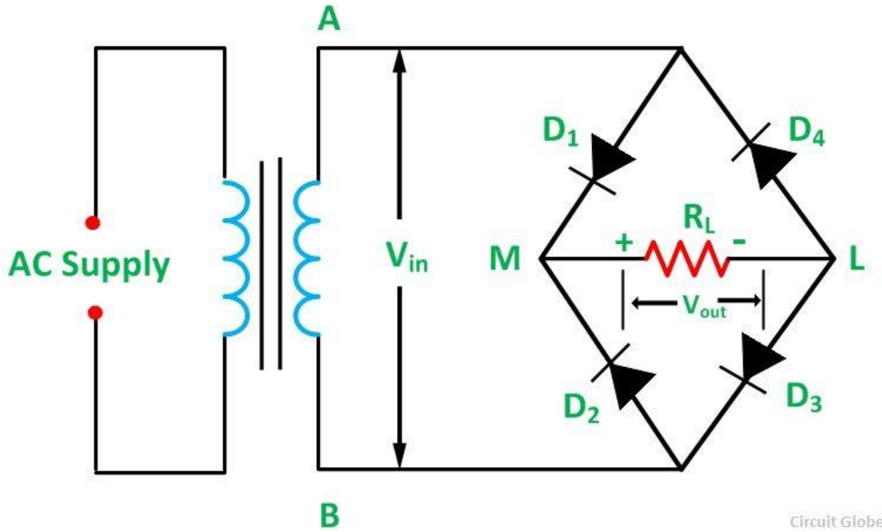
iv) **Current Gain:** It is a ratio of output current to input current.

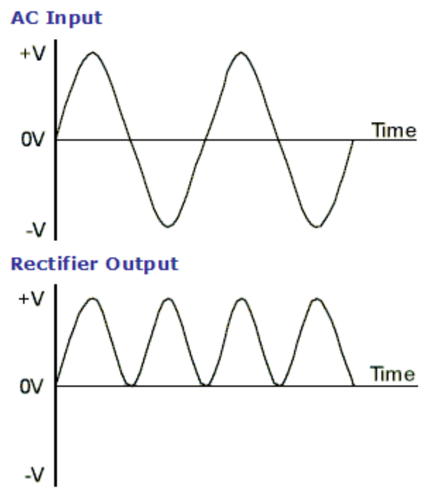
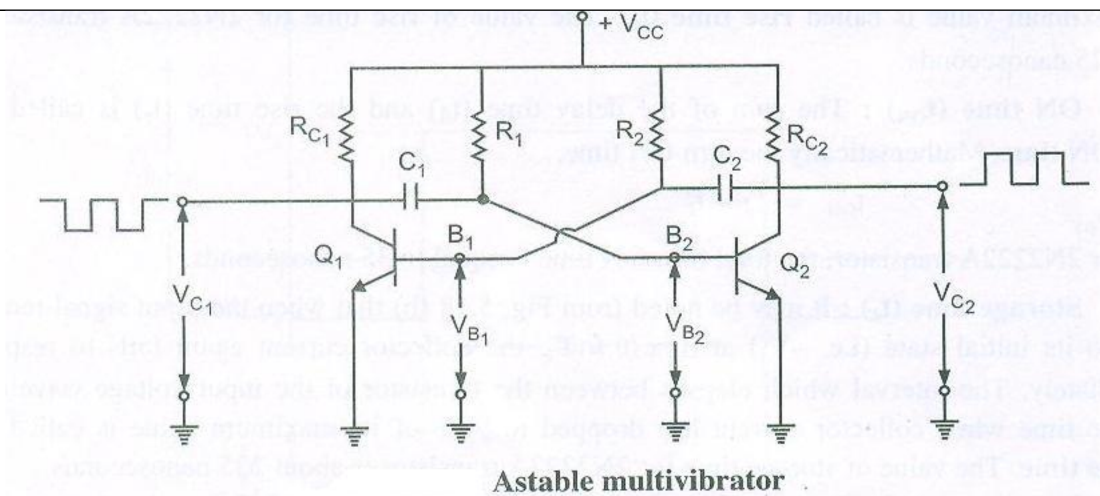
Each definition 1M

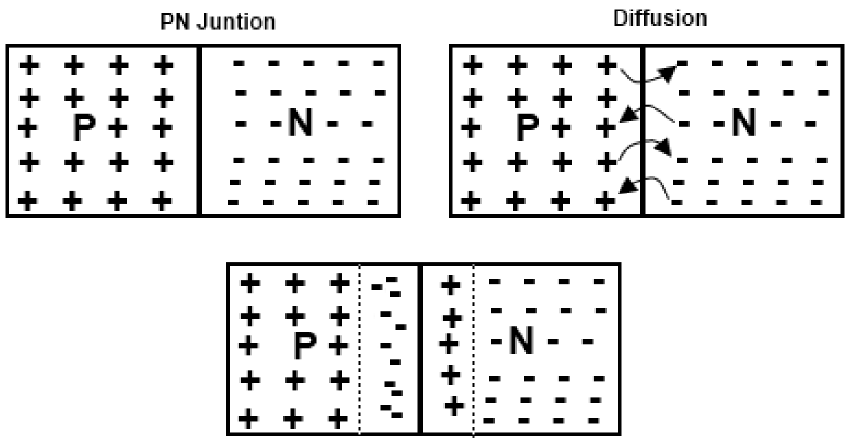
(d) Draw the circuit diagram of transformer coupled amplifier. **4M**

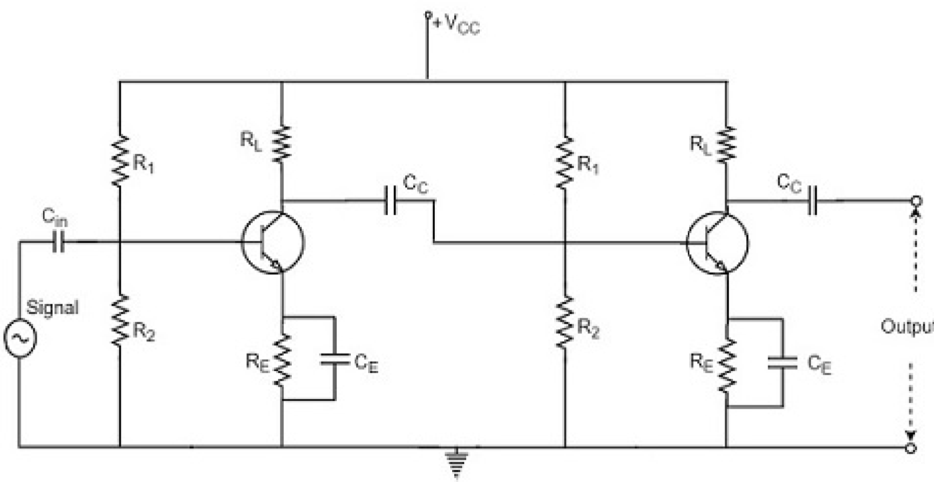
	Ans:		**4M**
	(e)	**State the need of rectifier and filter.**	**4M**
	Ans:	**Need of rectifier**: Every electronics circuit needs a D.C. power source for its operation. The rectifier circuit is used to convert A.C. supply to unidirectional pulses . **Need of filter:** A filter circuit is a device which removes unwanted A.C. component from rectified output, and allows only the D.C. components to reach the load. So filter is used to provide ripple free output.	**Need of rectifier-2M** **Need of filter-2M**
	f)	**List any two advantages and disadvantages of direct coupled amplifier over RC coupled amplifier.**	**4M**
		Advantages: • Due to absence of coupling capacitors, the gain does not reduce on the lower frequency side. • This amplifier can amplify dc signals.	**Any two Advantages-1M each** **Any two Disadvantages-**

		• Reduced cost and complexity due to absence of coupling capacitors. **Disadvantages:** • The output waveform has a dc shift. • Poor frequency response at a higher frequency.	**1M each**
Q. No.	Sub Q. N.	Answers	Marking Scheme
5.		**Attempt any four of the following:**	**16- Total Marks**
	a)	**Define:** **i) Knee voltage** **ii) Reverse saturation current**	**4M**
	Ans:	**i) Knee voltage :** The applied forward voltage, at which the PN junction starts conducting and current starts increasing exponentially is called knee voltage. It is 0.7V for Si and 0.3 for Ge diode. **ii) Reverse saturation current** The current produced due to minority carriers generated by thermal energy is known as reverse saturation current. (Io) (OR) The reverse saturation current is that part of the reverse current in a semiconductor diode caused by diffusion of minority carriers from the neutral regions to the depletion region.	**Each definition : 2M**
	b)	**Explain working of bridge rectifier with the help of waveform.**	**4M**

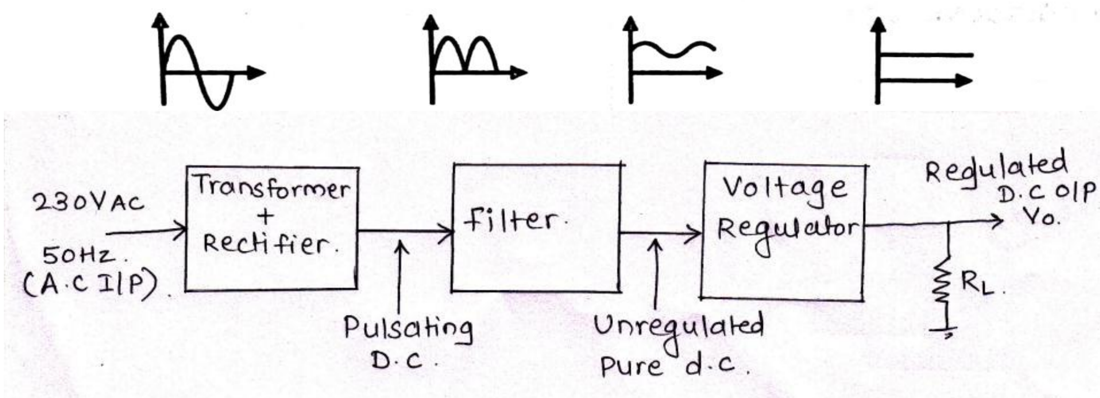
	Ans:	This type of single phase rectifier uses four individual rectifying diodes connected in a closed loop "bridge" configuration to produce the desired output. The single secondary winding is connected to one side of the diode bridge network and the load to the other side as shown below  **During Positive Half-cycle :** The four diodes labeled D_1 to D_4 are arranged in "series pairs" with only two diodes conducting current during each half cycle. During the positive half cycle of the supply, diodes D1 and D3 conduct in series while diodes D2 and D4 are reverse biased and the current flows through the load as shown below. **During Negative Half-cycle :** During the negative half cycle of the supply, diodes D2 and D4 conduct in series, but diodes D1 and D3 switch "OFF" as they are now reverse biased. The current flowing through the	**Circuit diagram : 1M** **Working : 2M** **Waveforms: 1M**

		load is as shown below.As the current flowing through the load is unidirectional, so the voltage developed across the load is also unidirectional. 	
	c)	**Draw the circuit diagram of Astable Multivibrator with any two application.**	**4M**
	Ans:	 **Applications of Astable Multivibrator** 1. It is used in square wave generator. 2. It is used for voltage to frequency converters. 3. In ramp generator. 4. In flasher circuit.	**Circuit diagram : 2M** **Any 2 relevant applications : 2M**

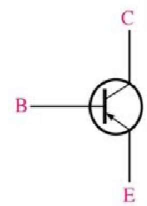
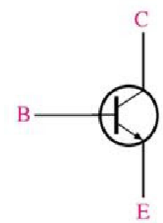
	d)	**Explain formation of depletion layer in P-N junction diode.**	**4M**
	Ans:	 Formation of Depletion Layer In PN Junction In an n-type semiconductor, the concentration of electrons is more compared to the concentration of holes. Similarly, in a p-type semiconductor, the concentration of holes is more than the concentration of electrons. During the formation of a p–n junction and because of the concentration gradient across the p and n sides, holes diffuse from the p-side to the n-side (p → n) and electrons diffuse from the n-side to the p-side (n → p). This motion of charge gives rise to a diffusion current across the junction. When an electron diffuses from n → p, it leaves behind an ionised donor on the n-side. This ionised donor (positive charge) is immobile as it is bonded to the surrounding atoms. As the electrons continue to diffuse from n → p, a layer of positive charge (or positive space–charge region) on n-side of the junction is developed. Similarly, when a hole diffuses from p → n due to the concentration gradient, it leaves behind an ionised acceptor (negative charge) which is immobile. As the holes continue to diffuse, a layer of negative charge (or negative space–charge region) on the p-side of the junction is developed. This space–charge region on either side of the junction together is known as the depletion region.	**Diagram : 2M** **Explanation : 2M**

e)	**Draw the circuit diagram of two stage amplifier and state the need of multistage amplifier.**	**4M**
Ans:	**Circuit diagram of two stage amplifier :**  **Need of multistage amplifier:** The output from a single stage amplifier is usually insufficient to drive an output device. So that additional amplification over two or three stages is necessary. • To achieve this, output of each amplifier stage is coupled in some way to the input of the next stage. The resulting system is referred to as multi-stage amplifier or cascade amplifier, where the output of first amplifier is fed as input to second amplifier. • To increase the overall gain of the amplifier multistage amplifier is needed.	**Circuit diagram : 2M** **(Note: transformer coupled and direct coupled amplifier can be considered)** **Need : 2M**
f)	**Write any four applications of Schottky diode.**	**4M**
Ans:	1) To rectify very high frequency signals. 2) As a switching device in digital computers. 3) In clipping & and clamping circuits. 4) In low power schottky TTL circuits.	**Any 4 applications : 4M**

		5) In mixing and detecting circuits used in communication systems. 6) In low voltage power supply circuits.	
Q. No.	Sub Q. N.	Answers	Marking Scheme
6.		**Attempt any four of the following::**	**16- Total Marks**
	a)	**Explain static and dynamic resistance of diode.**	**4M**
	Ans:	**Static resistance:** The resistance of a diode at the operating point can be obtained by taking the ratio of V_F and I_F. The resistance offered by the diode to the forward DC operating conditions is called as "DC or static resistance ". $R_F = \frac{DC\ Voltage}{DC\ current}$ When forward biased voltage is applied to a diode that is connected to a DC circuit, a DC or direct current flows through the diode. Direct current or electric current is nothing but the flow of charge carriers (free electrons or holes) through a conductor. In DC circuit, the charge carriers flow steadily in single direction or forward direction. **Dynamic resistance:** The resistance offered by a diode to the AC operating conditions is known as the "Dynamic Resistance ". (OR) Dynamic resistance is also defined as the ratio of change in voltage to the change in current. It is denoted as rf. $r_F = \frac{Change\ in\ Voltage}{Change\ in\ current}$ When forward biased voltage is applied to a diode that is connected to AC circuit, an AC or	**Static resistance: 2M** **Dynamic resistance: 2M**

		alternating current flows though the diode.	
	b)	**Draw the block diagram of regulated power supply and explain.**	**4M**
	Ans:	 Block diagram of D.C power supply. There are four basic blocks of a d.c. regulated power supply. They are 1) Step down transformer 2) Rectifier 3) Filter 4) Voltage Regulator. Functions of each block are as follows : **Step down transformer** : Reduces 230 volts 50Hz ac voltage to required ac voltage level. **Rectifier** : Rectifier converts ac voltage to unidirectional pulsating voltage. It may be a half-wave rectifier, a full-wave rectifier using a transformer with centre-tapped secondary winding or a bridge rectifier. **Filter** : Filter is a circuit used to remove fluctuations (ripple or ac) present in rectifier output. **Voltage Regulator** : Voltage regulator is a circuit which provides constant dc output voltage irrespective of changes in load current or changes in input voltage.	**Block diagram : 2M** **Explanation : 2M**
	c)	**Compare P.N.P and N.P.N transistor.**	**4M**
	Ans:	(table below)	**4 points : 4M (any other**

Parameter	PNP transistor	NPN transistor
Definition	Two blocks of p- types semiconductors are	Transistor in which two n-type layer are separated by

	separated by one thin block of n-type semiconductor.	one P-type layer	**relevant point can be consider ed)**
Symbol			
Direction of Current	Emitter to Collector	Collector to Emitter	
Majority Charge Carrier	Holes	Electrons	
Switching Time	Slower	Faster	
Positive Voltage	Emitter Terminal	Collector Terminal	
Ground Signal	High	Low	

d)	**Draw and explain the circuit diagram of transistor as a switch.**	**4M**

Ans:

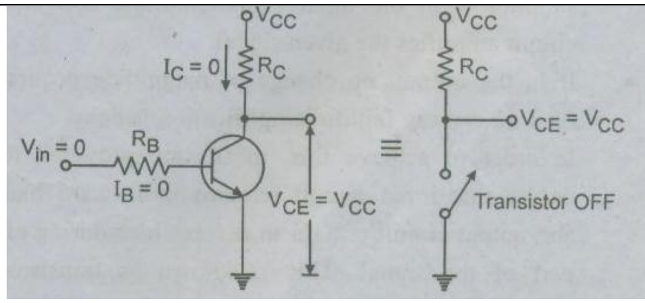
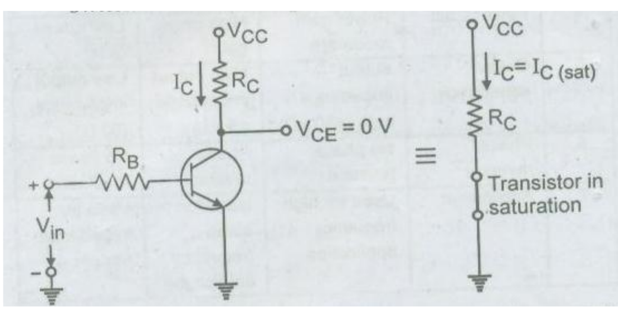
- The transistor can be used for two types of application viz. amplification and switching. For the amplification as a transistor is biased in its active region.
- Whereas for switching applications it is biased to operate in the saturation (full on) or cut off (full off) region.

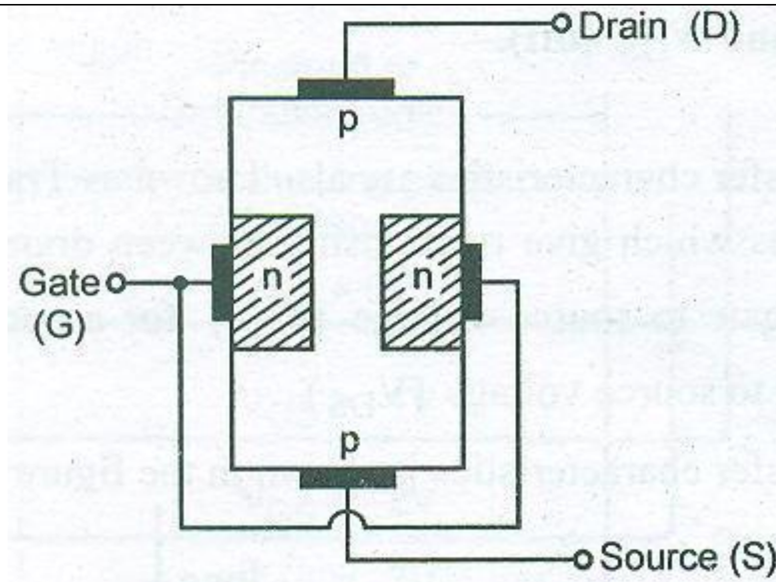
Diagram : 2M

Working : 2M

a. Transistor in cut- off region (open switch):

- In the cut –off region both the junction of a transistor are reverse biased and very small reverse current flows through the transistors.
- The voltage drop across the transistor (V_{CE}) is high. Thus, in the cut off region the transistor is equivalent to an open switch.
- Therefore , $V_{CE} = V_{CC}$

		 **b. Transistor in the saturation region(closed switch):** • When Vin is positive a large base current flows and transistor saturates. • In the saturation region both the junctions of a transistor are forward biased. The voltage drop across the transistor (V_{CE}) is very small, of the order of 0.2 V to 1V depending on the type of transistor and collector current is very large. In saturation the transistor is equivalent to a closed switch. • Therefore , V_{CE} = 0 	
	e)	**Explain the construction of P-channel J-FET.**	**4M**

	Ans:	 The construction diagram of P channel junction field effect transistor (JFET) is shown in above figure. It consist of a P type silicon bar with two N type heavily doped regions diffused on opposites sides of its middle part. The JFET in which the current conduction takes place only due to holes as majority charge carriers is known as P channel JFET. The two PN junctions are formed by the N region and the space between that is P region is called a channel. A single wire is taken in the form of the terminal when both the N type regions are connected internally. This is known as the **gate** (G). The electrical connection which is also known as ohmic contact are made to both ends of the P type semiconductor and are taken out in the form of two terminals called **drain** (D) and **source** (S). The **Drain** (D) is a terminal through which electrons enter the semiconductor bar and **Source** (S) is a terminal through which the electrons leave the semiconductor.	**Diagram : 2M** **Explanation : 2M**
	f)	**Define** **i) Ripple factor** **ii) TUF** **iii) Efficiency of Rectifier** **iv) PIV**	**4M**
	Ans:	**i) Ripple factor** Ripple Factor is the ratio of rms value of ac component present in the rectified output to the average value of rectified output.	**Each definition : 1M**

		$r = \frac{Vrrms}{Vdc} = \sqrt{(\frac{Irms}{Idc})^2 - 1}$ where Vrrms is ripple RMS voltage of rectified output Vdc is rectified output DC voltage **TUF** The transformer utilization factor (TUF) of a rectifier circuit is defined as the ratio of the DC power available at the load resistor to the AC rating of the secondary coil of a transformer. **ii) Efficiency of Rectifier** Efficiency of Rectifier is defined as the ratio of output DC power of the rectifier to the applied input AC power. $\eta = \frac{Pdc}{Pac}$ where Pdc is the output DC power of the rectifier Pac is the applied input AC power. **iii) PIV** Peak Inverse Voltage (PIV) refers to the maximum voltage a diode or other device can withstand in the reverse-biased direction before breakdown.	