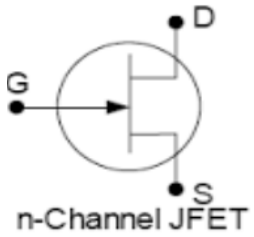
MODEL ANSWER

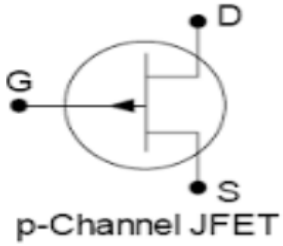
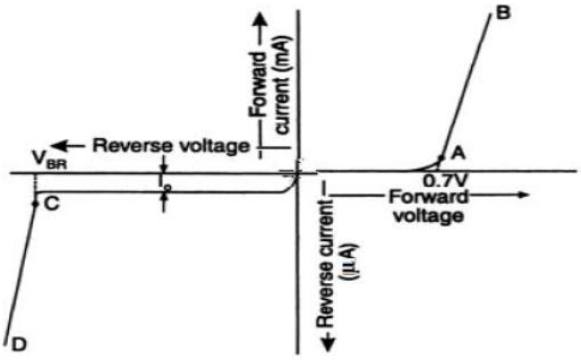
SUMMER– 17 EXAMINATION

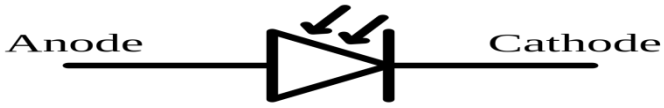
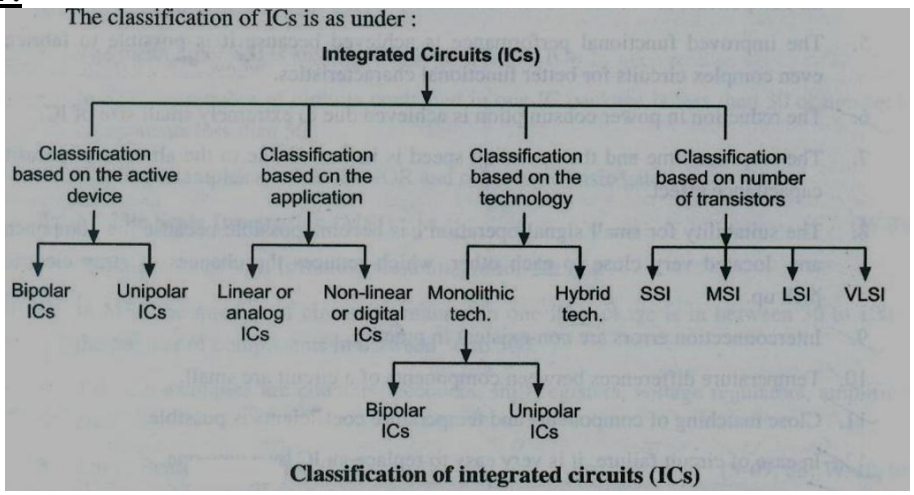
Subject Title: Basic Electronics Subject Code: 17213

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in 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 ten :**	**20-Total Marks**
	a)	**Define :** i) **Active components** ii) **Passive components.**	**2M**
	Ans:	**Active components** : The electrical components which are capable of amplifying or processing electrical signals are called active components. Example: Diode, Transistor etc. **Passive components:** The electrical components which are not capable of amplifying or processing electrical signals are called active components. Example: Inductor, Capacitor, Resistor etc.	**1M Each**
	b)	**Draw the symbol of** **i) N-channel JFET ii) P-channel JFET.**	**2M**
	Ans:	**Diagram :**  n-Channel JFET	**1M Each**

	 p-Channel JFET	
c)	**Draw V-I characteristics of PN diode.**	**2M**
Ans:	**Diagram :** 	**2M**
d)	**List any two types of couplings used in amplifier.**	**2M**
Ans:	1. Resistance – capacitance (RC) coupling. 2. Inductance (LC) coupling. 3. Transformer coupling (TC) 4. Direct coupling (D.C.)	**1M Each Any two**
e)	**Define Barrier potential. Give its values for Si and Ge diode.**	**2M**
Ans:	**Barrier Potential:** • The depletion layer of a PN junction has no mobile charge carriers. But it contains fixed rows of oppositely charged ions on its two sides.Because of this charge separation,an electric potential is established across the junction. • This electric potential is called potential barrier. • Barrier potential for Si Diode is 0.6 V and for Ge Diode is 0.2V.	**2M**
f)	**Give two advantages of ICS.**	**2M**
Ans:	**Advantage :** 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. 5. Temperature differences between components of a circuit are small. 6. Close matching of components and temperature coefficients is possible. 7. In case of circuit failure, it is very easy to replace an IC by a new one.	**1M Each Any Two**

	8. Active devices can be generously used as they are cheaper than passive components.	
g)	**Give necessity of filters in DC power supply.**	**2M**
Ans:	**Need of the filter:** The output of a rectifier contains ac and dc components. If such a dc is applied in an electronic circuit, it will produce noise and therefore to keep the ac components away from the load, filter circuits are used, which removes the ac components and allows only dc components to reach the load.	**2M**
h)	**Define transconductance of JFET.**	**2M**
Ans:	**Transconductance:** Transconductance is defined as the ratio of change in Drain current (ΔI_D) to change in Gate to Source Voltage (ΔV_{GS}) at a constant V_{DS}.	**2M**
i)	**Draw the symbol of.** **i) Varacter diode ii) LDR.**	**2M**
Ans:	**Diagram :**  Symbol of Varactor diode  **Symbol of LDR**	**1M Each**
j)	**Give classification of ICs.**	**2M**
Ans:	**Diagram :**  **Classification of integrated circuits (ICs)**	**2M**
k)	**Give two application of Light Emitting Diode.**	**2M**

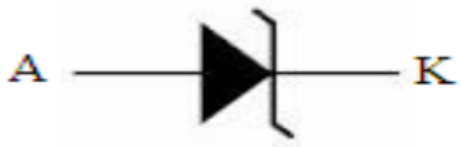
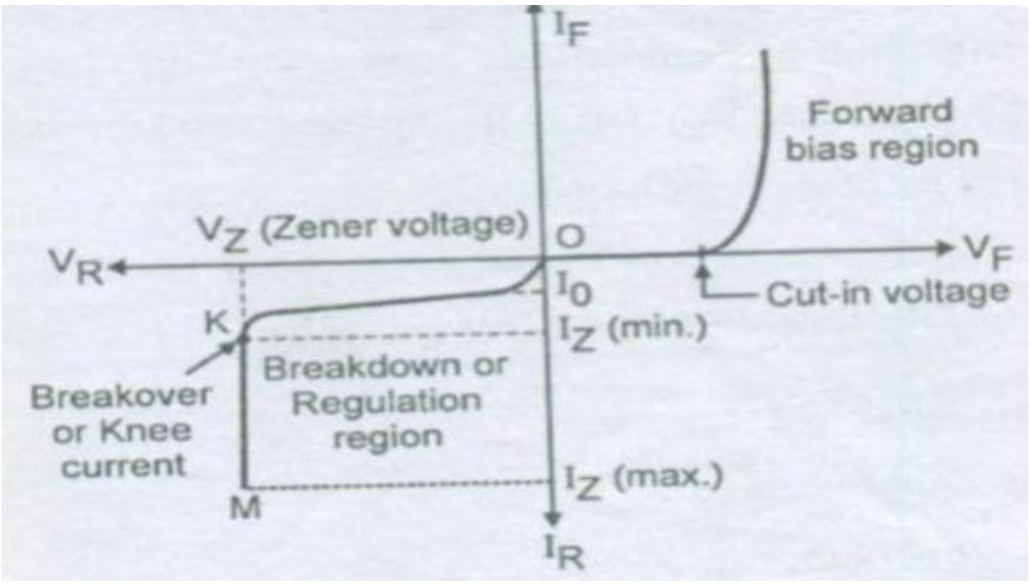
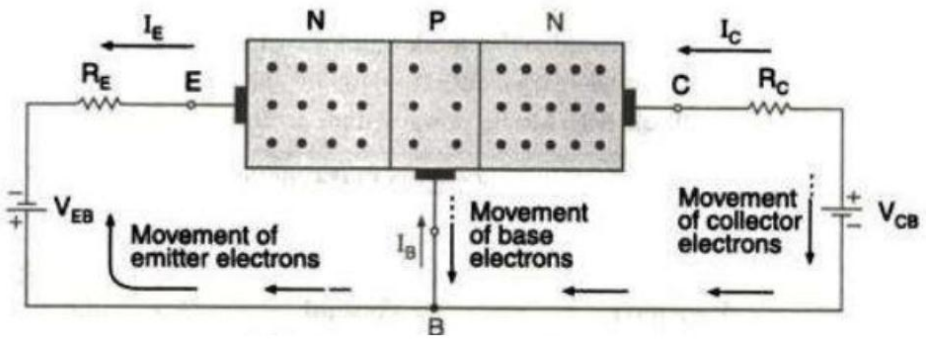
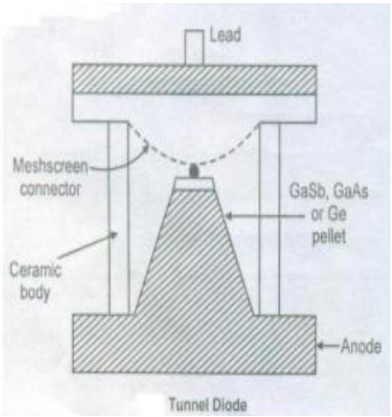
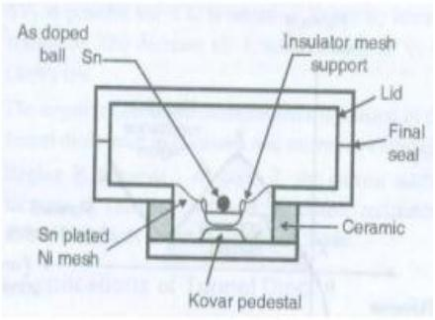
	Ans:	1. Infra-red LEDs are used in burglar alarm systems. 2. For solid state video displays which are rapidly replacing CRT. 3. An image sensing circuit for picture phones‟ 4. In array of different types for displaying alpha-numeric characters.	**2M** **Any two**
	l)	**Enlist two examples of non linear resistors.**	**2M**
	Ans:	**Examples of nonlinear resistors are**: 1. Thermistor 2. LDR 3. VDR	**1M Each**
Q 2		**Attempt any four :**	**16M**
	a)	**State any four applications of electronics in day to day life.**	**4M**
	Ans:	**Communication and Entertainment :** a) **Wire communication or Line communication.** Example **:** Telegraphy, Telephony, Telex and Teleprinter. b) **Wireless communication.** Example **:** radio broadcasting, TV broadcasting, satellite communication. **Defense :** The most important application is RADAR. **Industrial Applications :** Electronic circuits are used to control thickness, quality, weight and moisture. They are also used to amplify weak signals. **Medical sciences :** Electronics helps doctors and scientists in the diagnosis and treatment of various diseases. Eg. X-rays, ECG, Oscillographs and Short-wave diathermy units. **Instrumentation :** Instrumentation plays very vital role in research field and industry. Eg. Cathode Ray Oscilloscope (CRO), Frequency counter, Signal generator and Strain gauges.	**1M Each** **Any Four** **Points**
	b)	**Draw symbol of Zener Diode. Draw and explain its V-I characteristics.**	**4M**
	Ans:	**Symbol :**  Symbol of a Zener Diode	**1M**

		Diagram :  **Explaination:** The characteristics are similar to that of an ordinary silicon PN junction diode. It indicates that the forward current is very small for voltages below knee voltage and large forvoltages above knee (i.e. cut in) voltage. The reverse characteristics curve indicates that negligible reverse saturation current flows until wereach the breakdown (i.e. Zener) voltage Vz . The breakdown has a very sharp knee, followed by an almost vertical increase in reverse current. The voltage across the zener diode is approximately constant and equal to Zener voltage VZ over mostof the zener breakdown region**.** It will come out of the breakdown region, when the applied reverse voltage is reduced below the Zener breakdown voltage	**1 ½M** **1 ½M**
c)	**Draw neat sketch of NPN Transistor. Describe its working.**		**4M**
Ans:	**Diagram:**  		**2M**

		Working Working principle- Above fig shows NPN transistor with forward biased emitter-base junction and reverse biased collector-base junction. The forward bias causes the electrons in the N-type emitter to flow towards the base. This constitutes the emitter current IE.As these electrons flow through the P-type they tend to combined with holes. As the base is likely doped and very thin therefore only a few electrons (2%) combine with holes to constitute base current IB. The remaining electrons (98%) cross over in to the collector region to constitute collector current IC. In this way almost the entire emitter current flows in the collector circuit. It is clear that emitter current is sum of collector and base current. **IE = IB + IC**	**2M**
	d)	**Derive relation between α and β.**	**4M**
	Ans:	**relation between α and β:** We know, $I_E = I_B + I_C$ Dividing the above equation on both sides by I_C, $I_E/I_C = I_B/I_C + 1$ Since $I_C/I_E = \alpha$ and $I_B/I_C = \beta$ So, $I_E/I_C = 1/\alpha$ and $I_C/I_B = 1/\beta$ Therefore, $1/\alpha = 1/\beta + 1$ Or $1/\alpha = 1+\beta/\beta$ Therefore, $\alpha = \beta/(1+\beta)$ The above expression may be written as $\alpha(1+\beta) = \beta$ $\alpha + \alpha\beta = \beta$ $\alpha = \beta - \alpha\beta = \beta(1-\alpha)$ Therefore, $\beta = \alpha/(1-\alpha)$	**1M** **1M** **1M** **1M**
	e)	**Give construction and working of Tunnel diode.**	**4M**
	Ans:	**Diagram:**  **OR**	**2M**



Construction of Tunnel Diode

Working

The operation of tunnel diode is based on special characteristics known as negative resistance.

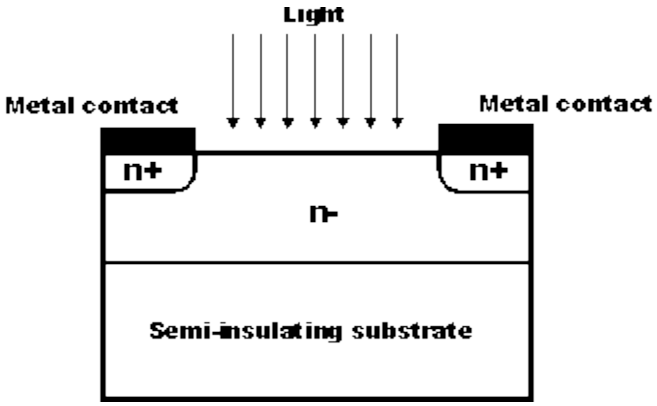
The width of the depletion region is inversely proportional to the square root of impurity concentration.

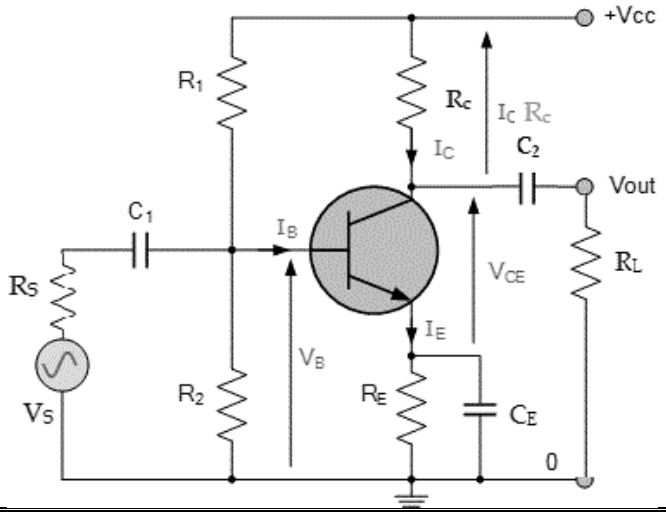
So increase in the impurity concentration, the depletion region width will reduce. The thickness of depletion region of this diode is so small. That indicates there is large probability of an electron can penetrate through this barrier.

This behavior is called is tunneling & hence the name of the high impurity density PN junction is called as tunnel diode.

2M

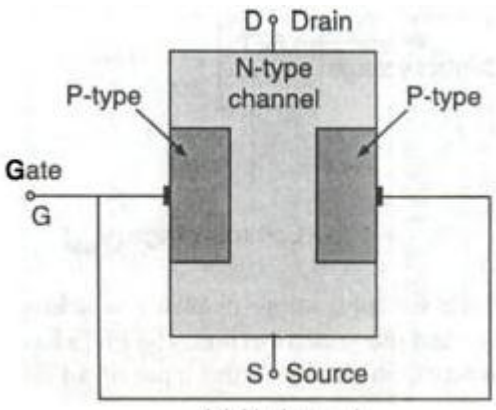
	f)	**Define Oscillator. Give Bark Hausen Criteria for sustained oscillations.**	**4M**
	Ans:	**Oscillator :** An oscillator is a electronic circuit that produces a periodic waveform on its output with only dc supply voltage as an input.	**2M**
		Bark Hausen Criterion for Oscillations: There is a necessity of a positive feedback for an electronic oscillator The overall voltage gain of a positive feedback amplifier is given by $A_{vf} = A_v / 1 - \beta . A_v$ If loop gain $\beta . A_v = 1$, then $A_{vf} = \infty$. The overall voltage gain will be infinity only when there is no input. Now the amplifier will start self-oscillating. This condition $\beta . A_v = 1$ is known as Barkhausen criterion. The conditions are started as under : 1. The sustained (i.e. continuous) oscillations are produced, if at the oscillation frequency, the magnitude of loop gain is slightly greater than unity. i.e. $\beta . A_v > 1$ or $A_v > 1/\beta$ 2. The total phase shift between the input and output signals is an integral or 2 radians i.e. $<\beta . A_v = 0^o$	**2M**
Q. 3		**Attempt any four:**	**16M**

	a)	**Give construction and working of LDR.**	**4M**
	Ans:	**Construction:** **Diagram :**  **Explanation :** The structure of a light dependent resistor consists of a light sensitive material which is deposited on an insulating substrate such as ceramic. The material is deposited in zigzag pattern in order to obtain the desired resistance & power rating. This zigzag area separates the metal deposited areas into two regions. Then the ohmic contacts are made on the either sides of the area. Materials normally used are cadmium sulphide, cadmium selenide, lead sulphide, indium antimonide and cadmium sulphonide. **Working Principle:** An LDR works on the principle of photo conductivity, which is an optical phenomenon in which the material's resistivity reduces when the light is absorbed by the material. When light falls i.e. when the photons fall on the device, the electrons in the valence band of the semiconductor material are excited to the conduction band. These photons in the incident light should have energy greater than the band gap of the semiconductor material to make the electrons jump from the valence band to the conduction band. Hence when light having enough energy is incident on the device more & more electrons are excited to the conduction band which results in large number of charge carriers. The result of this process is more and more current starts flowing and hence it is said that the resistance of the device has decreased.	**2M** **2M**
	b)	**Draw the neat sketch of common emitter amplifier.**	**4M**
	Ans:	**Diagram :**	**4M**



c)	**Give construction and working Field Effect Transistor.**	**4M**
Ans:	**Construction:**	**2M**

Diagram :



Explanation : **2M**

Consider an N-channel JFET as shown in fig. Here the P type Gate and N type channel constitute P-N junction. This P-N junction is always reverse biased in JFET operation. This reverse bias is applied by the voltage VGS. This reverse bias forms a depletion region within the channel when there is no applied voltage between the drain and the source. The depletion layer is symmetrical around the junction.

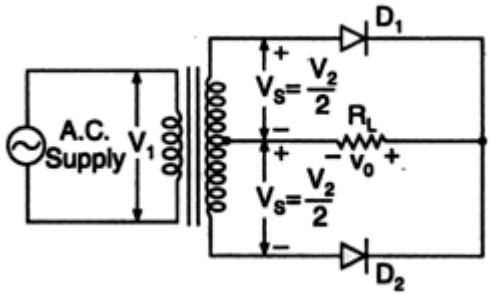
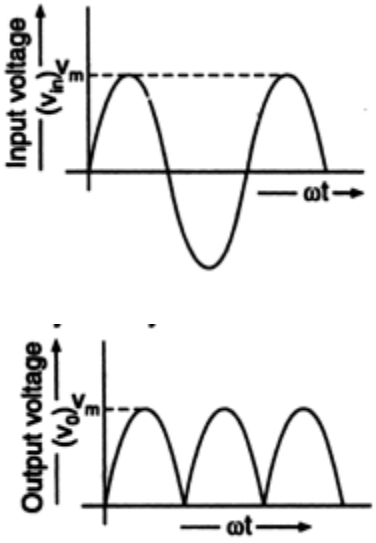
Working:

When voltage is applied between the drain and source with DC supply V_{DS}, electrons flow from source to drain through the narrow channel existing between the depletion regions. This causes a drain current I_D to flow from drain to source. The value of drain current is maximum, when no external voltage is applied between gate and source. This maximum drain current is denoted by I_{DSS}.

It is observed that the channel is narrower at the drain end. This happens because amount of reverse bias is not same throughout the length of P-N junction.

When the gate to source voltage V_{GS} is increased above zero, the reverse bias voltage across gate to source increases. As a result, the width of the depletion region increases. This reduces the width of the channel and thus controls the drain current I_D. When V_{GS} is increased further, a stage is reached at which two depletion regions touch each other as

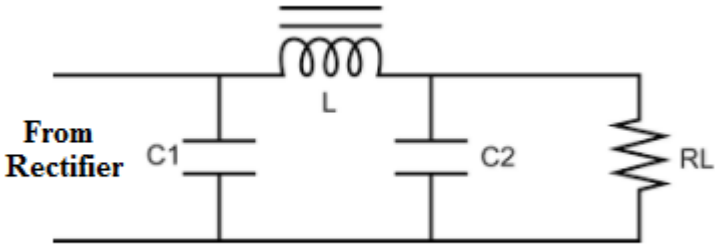
		shown in the fig. This voltage between gate and source at which drain current pinches off is called pinch off voltage and is denoted by V_P.	
	d)	**Give two applications of** **a) Varacter diode b) Tunnel diode.**	**4M**
	Ans:	**Applications of Varacter Diode:** • Voltage controlled oscillators • RF filters • Tuning Circuits • High frequency amplifiers **Applications of Tunnel Diode:** • High speed switches • High frequency oscillator • Micro wave generators and amplifiers	**1M Each Any Two Points**
	e)	**Given I_B =110μA, I_C =2mA. For a transistor find α and β.**	**4M**
	Ans:	Given I_B = 110μA I_C = 2mA Calculation of α : $I_E = I_B + I_C$ $I_E = 110 \times 10^{-6} + 2 \times 10^{-3}$ $= 2.11$ mA. $\alpha = \frac{I_C}{I_E}$ $\alpha = \frac{2 X 10^{-3}}{2.11 X 10^{-3}} =$ **0.948.** Calculation of β : $\beta = \frac{I_C}{I_B}$ $\beta = \frac{2 X 10^{-3}}{110 X 10^{-6}} =$ **18.2** OR $\beta = \frac{\alpha}{1-\alpha} = \frac{0.948}{1-0.948} =$ **18.2**	**2M** **2M**
	f)	**Describe the need of multistage amplifier.** **i/p** → **Stage 1 Gain = 4** → **Stage 2 Gain = 5** → **o/p** **Find our overall gain.**	**4M**
	Ans:	**Need of Multistage amplifier:** • Amplification of single stage is not sufficient. • Output or input impedance is not of required values. • To obtain required voltage, current and power gain.	**1M Each Any Two**

		Given diagram, Stage1 Gain = A_{V1} = 4; Stage 2 Gain = A_{V2} = 5 Overall gain = $\mathbf{A_V = A_{V1} X A_{V2}}$ = 4 X 5 = **20**.	**2M**
Q. 4		**Attempt any four :**	**16M**
	a)	**Give four applications of Schottky diode.**	**4M**
	Ans:	**Applications** : • To rectify very high frequency signals • As a switching device in digital computers • In clipping and clamping circuits • In low power Schottky TTL circuits • In mixing and detecting circuits used in communication systems. • In low voltage power supply circuits	**1M** **Any Four**
	b)	**Draw the neat sketch of center tap full wave rectifier. Draw input and output waveforms.**	**4M**
	Ans:	**Diagram :**  **Waveform:**  	**Any Correct diagram – 2M; Waveform- 2M**
	c)	**Compare BJT and FET (any four points).**	**4M**
	Ans:		

Sr. no.	BJT	JFET

			1.	It is bipolar device i.e. current in the device is carried by electrons and holes.	It is unipolar device i.e. current in the device is carried by either electrons or holes.	**1M Each Any four points**
			2.	It is current controlled device i.e. base current controls the collector current.	It is voltage controlled device i.e. voltage at the gate terminal controls the amount of current flowing through the device.	
			3.	Input resistance is low, of the order of several KΩ	Input resistance is very high, of the order of several MΩ	
			4.	It has positive temperature coefficient of resistance at high current levels i.e. current increases as the temperature increases.	It has negative temperature coefficient of resistance at high current levels i.e. current decreases as the temperature increases.	
			5.	It suffers from minority carrier storage effects and therefore has lower switching speeds and cut-off frequency.	It does not suffer from minority carrier storage effects and therefore has higher switching speeds and cut-off frequency.	
			6.	It is more noisy as compared to FET.	It is less noisy.	
			7.	It is complicated to fabricate as an IC and occupies more space on the IC chip.	It is much simpler to fabricate as an IC and occupies less space on the IC chip.	
			8.	Thermal break down can occur.	Thermal break down cannot occur.	

d)	**Draw and explain working of CLC filter.**	**4M**
Ans:	***(Note any other diagram showing rectifier with filter may also be considered)***	
	Diagram:	**2M**

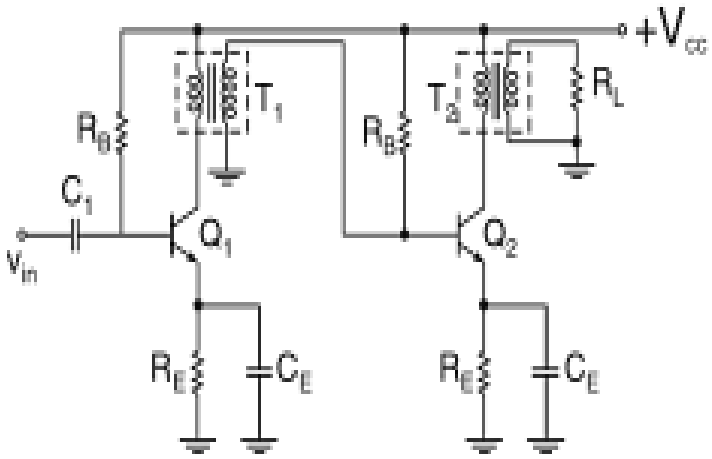
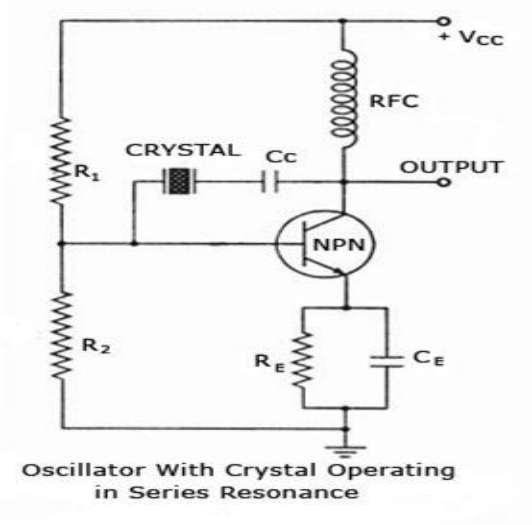


Explanation : **2M**

CLC filter or π filter is used whenever a low output current and a high dc output voltage is required. It consists of two capacitors C_1 and C_2 and an inductor L connected in the form of Greek letter π. The pulsating output from the rectifier is applied at the input terminals of the π filter.

Working:

Capacitor C_1 filter: It offers a low reactance to ac component of rectifier output. This capacitor bypasses most of the ac component to the ground, while dc component moves

		towards L. Inductor L : It offers a high reactance to the ac component of the rectifier output but zero resistance to the dc component. Thus, it allows the dc component to pass through it, and blocks the ac component, which could have been bypassed by the capacitor C_1. Capacitor C_2 : This works similar to C_1. It bypasses the ac component of rectifier output, which could not be blocked by Inductor L. Thus only dc component is available at the output. The ripple factor is given by $\gamma = \frac{5700}{C_1 C_2 L R_L}$	
	e)	**Draw the neat sketch of two stage transformer coupled amplifier.**	**4M**
	Ans:	**Diagram :** 	**4M**
	f)	**Draw and explain construction and working of crystal oscillator circuit.**	**4M**
	Ans:	**Diagram :**  Oscillator With Crystal Operating in Series Resonance **Explanation**: • A piezoelectric quartz crystal is used as in Crystal Oscillators. • Piezoelectric effect : when ac voltage applied across the quartz crystal, it vibrates at the frequency of the applied voltage. Conversely, if a mechanical force is applied to vibrate a quartz crystal, it generates an a.c. output.	**2M** **2M**

- Resistors R_1, R_2 and R_E form the voltage divider biasing circuit, fixes the Q point. Crystal connected as a series element in the feedback path from collector to base.
- Capacitor C_E parallel with R_E provides low reactance path to the amplified AC signal.
- RFC coil provides the dc bias also couples any ac signal from affecting the output signal
- C_c with negligible impedance blocks dc between collector and base.

Q.5 **Attempt any four :** **16M**

a) **Describe process of formation of Depletion Layer.** **4M**

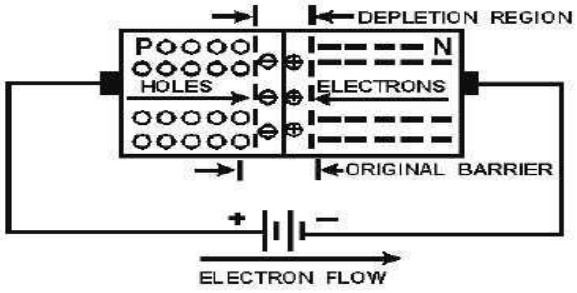
Ans: **4M**

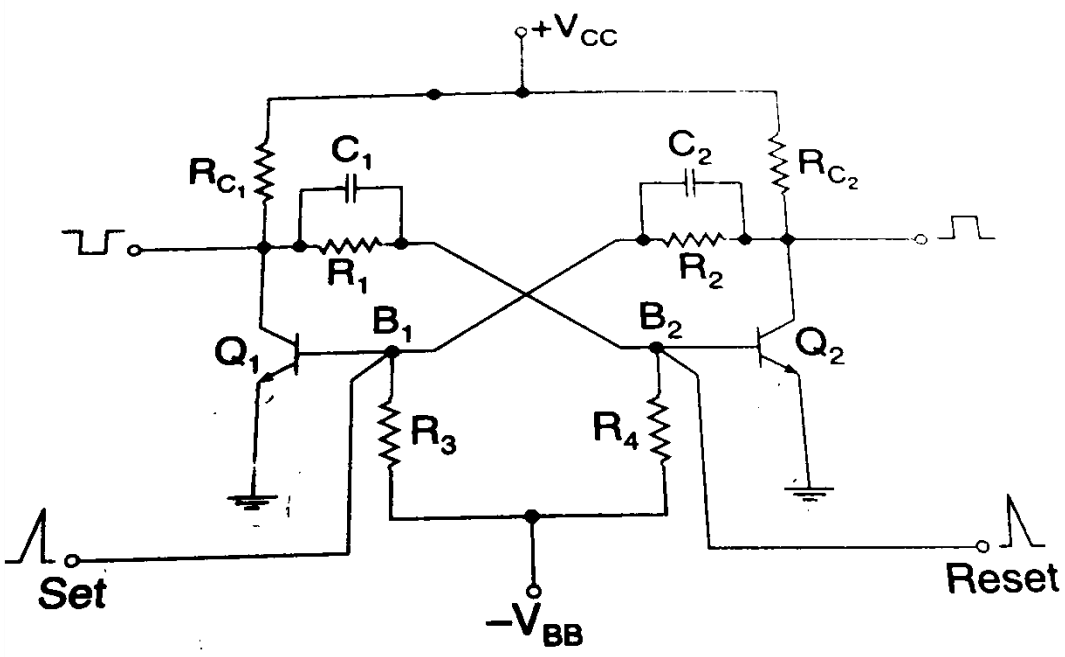
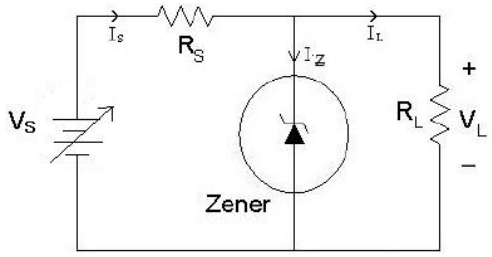
- **Depletion Layer :** If we join a piece of p – type semiconductor to a piece of n – type semiconductor such that the crystal structure remains continuous at boundary a PN junction is formed.
- As soon as the junction is formed following process takes place.
- The holes from the p – region diffuse to the N – region where they combine with the free electrons. Each hole that diffuses into the N-side will behind a negative immobile ion on the n-side
- The free electrons from N – region diffuse to the P – region where they combine with holes. Each electron that diffuses into the p-side will behind a positive immobile ion on the n-side
- The negative acceptor ions in the P region and positive donor ion in the N region are left uncovered in the vicinity of junction.
- When sufficient negative ions get accumulated in the p-region near the junction, the electrons experience the force of repulsion while diffusing from n-region to p-region. Hence, diffusion stops.
- Similarly, the positive ions near the junction in n-region repel the holes so that the diffusion of holes too stops.
- This layer of ions is termed as **depletion layer.**

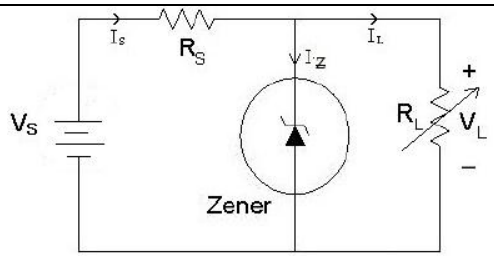
b) **Compare Half wave, full wave, full wave center tap and full wave bridge type rectifier (four points).** **4M**

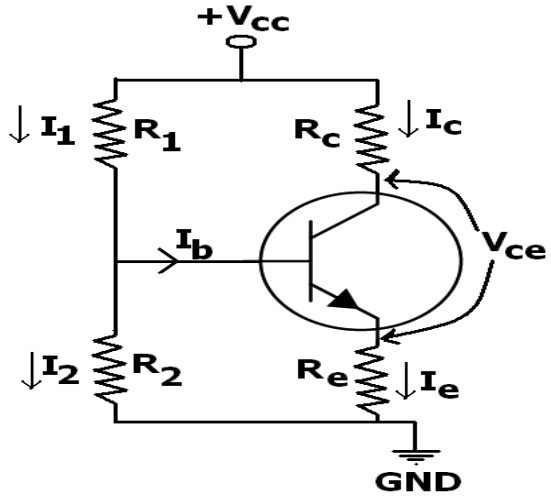
Ans: **1M Each Any four points**

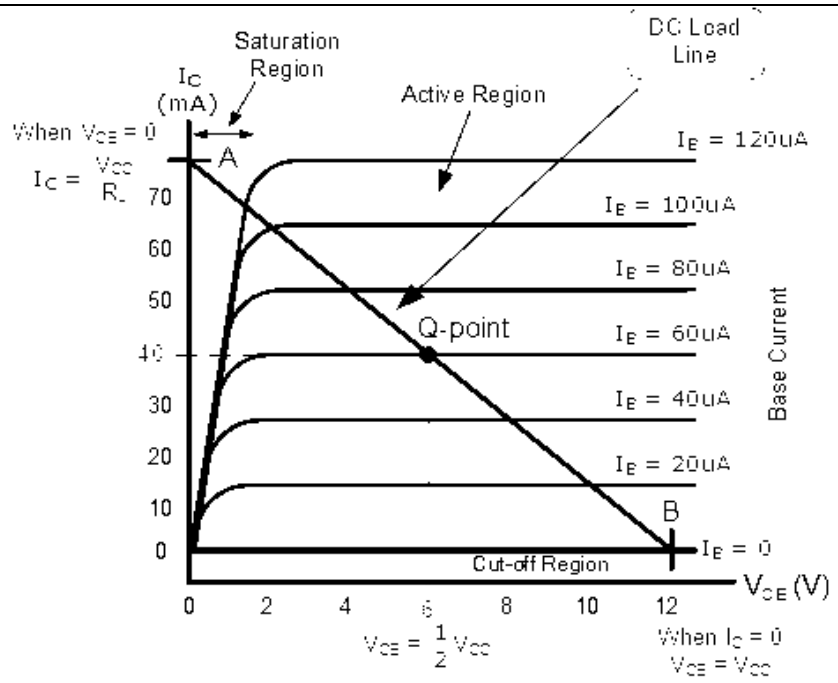
Parameter	Half wave	Full wave center tap	Full wave bridge
Dc or average load current	I_m/π	$2\ I_m/\pi$	$2\ I_m/\pi$
Max average load voltage	V_m/π	$2\ V_m/\pi$	$2\ V_m/\pi$
RMS load current	$I_m/2$	$I_m/\sqrt{2}$	$I_m/\sqrt{2}$
RMS load voltage	$V_m/2$	$V_m/\sqrt{2}$	$V_m/\sqrt{2}$
Max rectification efficiency	40.6%	81.2%	81.2%
Dc load power	$I_m^2 . R_L/\pi^2$	$4. I_m^2 . R_L/\pi^2$	$4. I_m^2 . R_L/\pi^2$
Ripple factor	121 %	48 %	48 %
TUF	28.7 %	69.3 %	81.2 %
Ripple frequency	50 Hz	100 Hz	100Hz
No of diodes	1	2	4

	PIV	V_m	$2V_m$	V_m	
	c)	**State and explain the operating principle of P-N junction diode under forward bias condition.**	**4M**
	Ans:	**Diagram :**  **Explanation :** • The process of applying and external voltage to a junction in such a direction that it cancels the potential barrier, thus permitting the current flow is called as forward biasing. • If the p-region (anode) is connected to the positive terminal of the external source and n-side (cathode) connected to the negative terminal of the external source, then the diode is said to be forward biased. It is shown in the fig above. Conventional current flows in the direction opposite to the flow of electrons. • The applied forward potential establishes an electric field, which acts against the field due to potential barrier. Therefore, the resultant field is weakened and the barrier height is reduced at the junction. The holes and electrons are attracted to opposite polarities of the battery and start to make efforts to cross the junction. • As potential barrier is very small, a small forward voltage is sufficient to completely eliminate the barrier. • Once the potential barrier is eliminated by forward voltage, junction resistance almost becomes zero and a low resistance path is established for entire circuit. Therefore, current flowing in the circuit is called as forward current.	**2M** **2M**
	d)	**Give construction of Bistable multivibrator using transistor.**	**4M**
		Diagram :	**4M**

			
	e)	**List two advantages and disadvantages of R-C coupled amplifier.**	**4M**
		Advantage • Most convenient and least expensive • Wide frequency response and large bandwidth • Provide excellent audio fidelity • Provides less frequency distortion. **Disadvantage** • Voltage gain reduces as low frequency • Overall gain of amplifier is comparatively less • Provides poor impedance matching between amplifier stage. • Tendency to become noisy with age	**1M Each Any Two** **1M Each Any Two**
	f)	**Describe working of Zener diode as voltage regulator.**	**4M**
		Diagram :  **OR**	**2M**

			
		Working : • A zener diode can be used as voltage regulator to provide a constant voltage from a source whose voltage may vary over sufficient range. **CASE 1: varying input voltage** • As input voltage increases, I_s also increases. This increases the current through the Zener. Without affecting I_L. The increase in input current will also increase voltage drop across series resistance there by keeping load voltage V_L constant. • On the other hand if V_s decreases, I_s and I_z decreases voltage across R_S decreases. Thus V_L and I_L remain constant. **CASE 2: varying load resistance** • If R_L increases, I_L decreases but I_s = constant hence I_z increases and output will remain constant till I_z is less than I_{zmax} . • If R_L decreases, I_L increases but I_s = constant hence I_z decreases and output will remain constant till I_z is higher than I_{zmin}.	**2M**
Q.6		**Attempt any four :**	**16M**
	a)	**Describe static resistance and dynamic resistance of PN junction diode.**	**4M**
	Ans:	**Static Resistance :** • The resistance offered by a diode to dc operating conditions is called as dc or static resistance and is denoted as R_f. • When dc voltage is applied to the diode, a dc current will flow through it. The resistance at the operating point can be calculated by taking the ratio of V_f and I_f. • $R_f = V_f / I_f$ **Dynamic Resistance :** • The resistance offered by the diode to ac operating conditions is called as ac or dynamic resistance and is denoted by R_f. • The operating point of the diode does not remain fixed. • It can be defined as the ratio of change in input voltage to the change in current. • $R_f = \Delta V_f / \Delta I_f$	**2M Each**
	b)	**Define rectifier. State its need. Define the terms :** **i) Ripple Factor ii) Efficiency.**	**4M**
	Ans:	**Rectifier :**	**1M**

		A rectifier is a device that converts an AC signal into pulsating DC signal. **Need of rectifier :** Every electronic circuit such as an amplifier needs dc power supply for its operation. This dc voltage has to be obtained from ac supply. For this a.c supply voltage has to be reduced first using a step down transformer and then converted to dc by using a rectifier**.** **Ripple factor :** The ratio of R.M.S value of a.c. component to the d.c. component in the rectifier output is known as RIPPLE FACTOR. **Efficiency :** It is defined as the ratio of d.c power delivered to the load to the a.c input power from the secondary winding of the transformer.	**1M** **1M** **1M**
c)		**Define "Biasing of Transistor." Explain in brief voltage divider biasing.**	**4M**
Ans:		**Biasing of Transistor:** The application of a suitable Dc voltage across the transistor terminals is called biasing. **Voltage divider biasing:** **Diagram :**  • The voltage divider is formed using external resistor R1 and R2. The voltage across R2 forward biases the emitter junction. By proper selection of resistors R1 and R2, the operating point of the transistor can be made independent of Ic. • In this circuit, the voltage divider holds the base voltage fixed independent of base current provided the divider current is large compared to the base current. • However, even with a fixed base voltage, collector current varies with temperature (for example) so an emitter resistor is added to stabilize the Q-point	**2M** **2M**
d)		**Draw DC load line of transistor. Explain working of transistor as a switch.**	**4M**
Ans:		**Diagram :**	**2M**



2M

Transistor as switch:

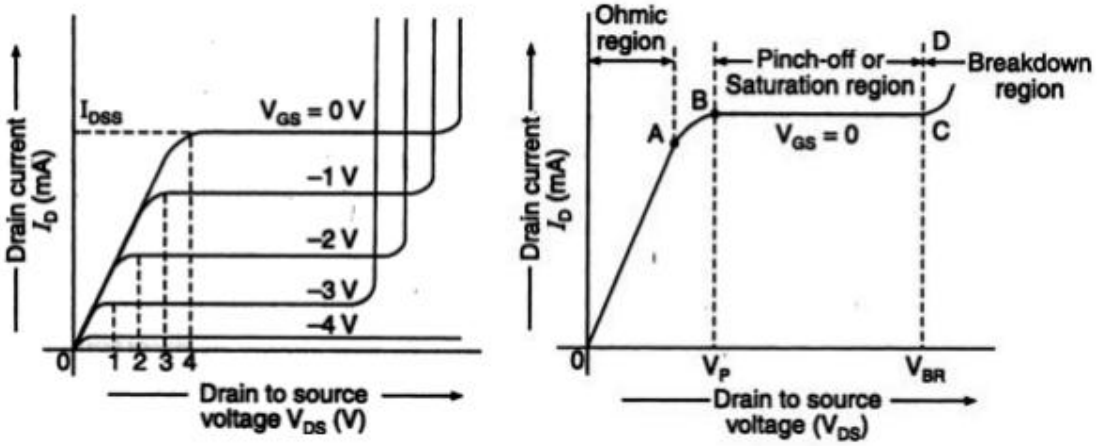
Closed switch:

In saturation mode both emitter base and collector base junctions of transistor are forward biased. In this mode transistor has a very large value of current. The transistor is operated in this mode when it is used as a closed switch

Open switch:

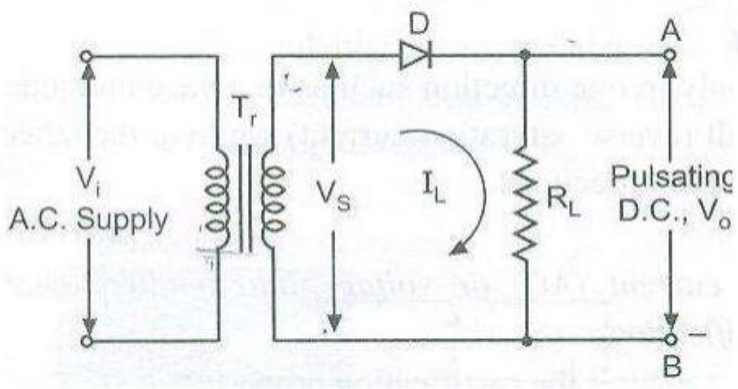
In cut off mode both emitter base and collector base junctions of a transistor are reverse biased. In this mode transistor has practically zero current. The transistor is operated in this mode when it is used as an open switch.

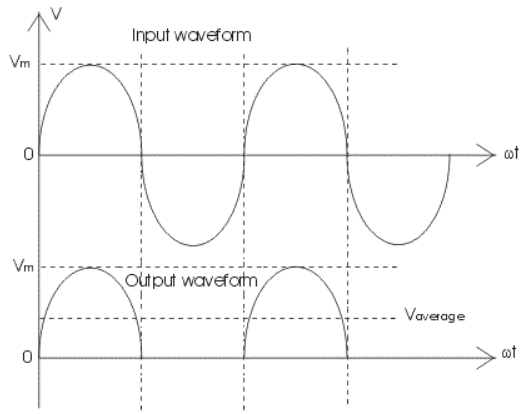
e)	**Draw and explain Drain characteristics of JFET.**	**4M**
Ans:	**Diagram :**	**2M**



Explanation : **2M**

These curves give relationship between drain current ID and drain to source voltage VDS for different values of gate to source voltage (VGS).

		Ohmic Region: Shown by curve OA in fig (b). In this region the drain current increases linearly with the increase in drain to source voltage VDS. JFET acts as a simple resistor. **Curve AB**: In this region the drain current increases slowly as compared to that in the Ohmic Region. This is because with increase in drain to source voltage, the drain current increases. This in turn increases the reverse bias voltage across the gate source junction. As a result of this the depletion region grows in size, thereby reducing the effective width of the channel. **Pinch-off Region**: This region shown by BC curve. It is also called saturation Region or constant current region. In this region, the drain current remains constant at its maximum value. The pinch-off region is the normal operating region of JFET, when it is used in an amplifier circuit. **Break down Region**: This region shown by curve CD. In this region the drain current increases rapidly as the drain to source voltage increases. This happens because of break down of gate to source junction due to avalanche breakdown. The drain to source voltage corresponding to point C is called breakdown voltage VBR	
	f)	**Draw neat sketch of half wave rectifier. List its two disadvantages. Draw input out waveforms.**	**4M**
	Ans	**Half Wave Rectifier :** **Diagram :**  **Disadvantages :** • Since its ripple factor is very high, thus a big filtering circuit is required. • The efficiency is very low since output is delivered only for half the time. • Transformation Utilization factor is low. • Saturation of the transformer core results in hysteresis losses **Waveform :**	**2M** **1M** **1M**

		 V Input waveform Vm 0 ωt Vm Output waveform Vaverage 0 ωt	