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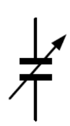
WINTER – 2018 EXAMINATION
MODEL ANSWER

Subject: BASIC ELECTRONICS **Subject Code:** 22225

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 any equivalent 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
1.	 **(a)** **Ans.**	**Attempt any FIVE of the following:** **Draw the symbol of inductor and capacitor. State the unit of inductor and capacitor.** Symbol of Inductor:  **OR**  Symbol of Capacitor:  **OR**  **OR**  **OR**  Unit of Inductance : Henry OR H Unit of capacitance : farad OR F	**10** **2M** ***Each symbol ½ M*** ***Each Unit ½ M***

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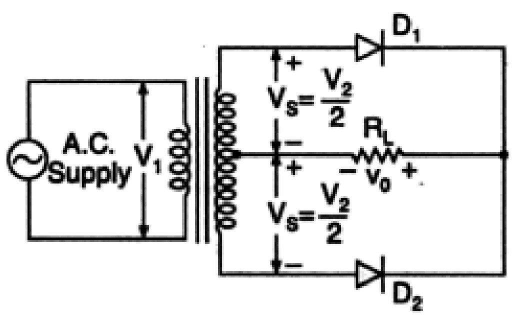
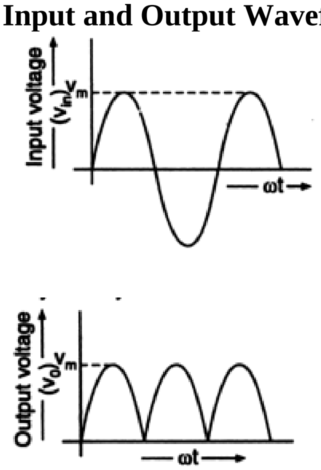
	(b) **Ans**	**State the need of filters. Define filter.** **Need**: In dc power supplies, the output of a rectifier contains dc component as well as ac component. The presence of the ac component is undesirable and must be removed so that pure dc can be obtained. Thus filters circuits are required. **Filters**: Filters are electronic circuits (consisting of inductors and capacitors) which remove or minimize unwanted ac component of the rectifier output and allows only the dc component to reach the load.	**2M** ***Need 1M*** ***Definition 1M***
	(c) **Ans**	**Define α and β of transistor.** **α (Alpha)** : This is the Common Base dc current gain. It defined as the ratio of collector current (I_C) to emitter current (I_E). $\alpha = \frac{I_C}{I_E}$ **β (Beta):** This is the Common Emitter dc current gain. It is defined as the ratio of collector current (I_C) to the base current (I_B). $\beta = \frac{I_C}{I_B}$	**2M** ***Each definition 1M***
	(d) **Ans**	**Define amplification factor and trans-conductance of JFET.** **Amplification factor:** Amplification factor (μ) of a JFET is the ratio of change in drain voltage to gate voltage keeping constant drain current. This indicates how much more control the gate voltage has over drain current compared to the drain voltage. $\mu = \frac{\Delta V_{DS}}{\Delta V_{GS}}$ keeping I_D constant.	**2M** ***Each definition 1M***

		Transconductance: The transconductance g_m is the change in the drain current for a given change in gate to source voltage with constant drain to source voltage. $g_m = \frac{\Delta I_D}{\Delta V_{GS}}$ keeping V_{DS} constant.	
	(e) **Ans**	**State the two advantages and disadvantages of integrated circuits.** **Advantages of Integrated circuits:** • Small in size due to the reduced device dimension. • Low weight due to very small size. • Low power requirement due to lower dimension and lower threshold power requirement. • Low cost due to large-scale production. • High reliability due to the absence of a solder joint. • Increased speed. • Easy replacement instead of repairing as it is economical. • Higher yield, because of the batch fabrication. **Disadvantages of Integrated circuits:** • IC resistors have a limited range. • Generally inductors (L) cannot be formed using IC. • ICs are delicate and cannot withstand rough handling • Limited amount of power handling. • Lack of flexibility. • Higher value capacitors cannot be fabricated.	**2M** ***Each advantage and disadvantage - ½M***
	(f) **Ans**	**Define transducer and name two passive transducers.** Transducer is a device that converts one form of energy into another form of energy. A transducer is a device which converts a physical quantity such as temperature, pressure, displacement, force etc., into equivalent electrical quantity either voltage or current. Examples of Passive transducers: • RTD • Inductive transducers	**2M** ***Definition 1M*** ***Each Example ½M***

		• Capacitive transducers • LVDT • LDR • Strain gauge • Thermisters	
	(g) **Ans**	**State seebeck and Peltier effect.** **Seebeck effect**: This states that whenever two dissimilar metals are connected together to form two junctions out of which, one junction is subjected to high temperature and another is subjected to low temperature then e.m.f is induced and it is proportional to the temperature difference between two junctions. **Peltier effect**: This states that for two dissimilar metals in a closed loop, if current is forced to flow through, then one junction will be heated and other will become cool. **OR** It is the presence of heating of one junction and cooling of the other when electric current is maintained in a circuit of material consisting of two dissimilar conductors.	**2M** ***Each Definition 1M***
2.	 **(a)** **Ans.**	**Attempt any THREE:** **Determine the value of capacitance with the following colour code.** **(i) Orange, Orange, Blue** **(ii) Yellow, Violet, Yellow** **(i) Orange, Orange, Blue** **Colour coding:** Orange Orange Blue ↓ ↓ ↓ 3 3 6 **Value of capacitor:** 33×10^{6} pF $= 33 \times 10^{6} \times 10^{-12}$F $= 33 \times 10^{-6}$ F **= 33μF**	**12** **4M** ***Colour coding 1M***

		ii) Yellow, Violet, Yellow Yellow → 4, Violet → 7, Yellow → 4 Value of capacitor : 47×10^4 pF = 470KpF **OR** $= 47 \times 10^4 \times 10^{-12}$F $= 47 \times 10^{-8}$ F = **0.47µF**	***Correct answer with unit 1M***
	(b) **Ans**	**Draw the neat sketch of center tap full wave rectifier. Draw i/p and o/p waveforms.** **Circuit Diagram**  **Input and Output Waveforms** 	**4M** ***Any other relevant circuit Diagram 2M*** ***Wavefor ms 2M***

(c) Draw and explain zener diode as a voltage regulator. **4M**

Ans

Zener diode as voltage regulator

A reverse biased Zener diode is used to provide a constant voltage across the load resister R_L. The voltage regulator circuit diagram showing the Zener diode is as given below.

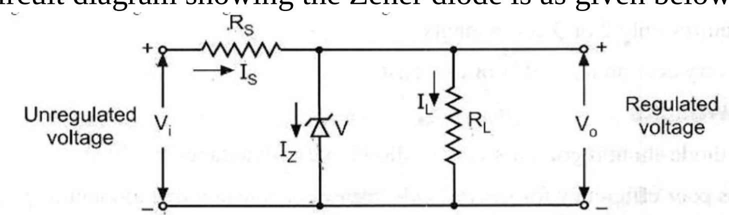


Diagram 2M

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.

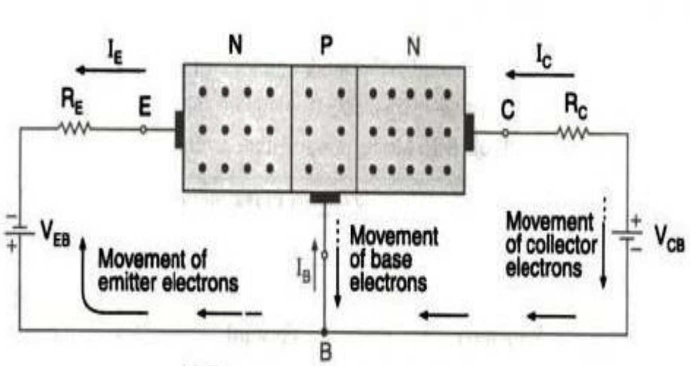
Regulation with varying input voltage: (Line Regulation)

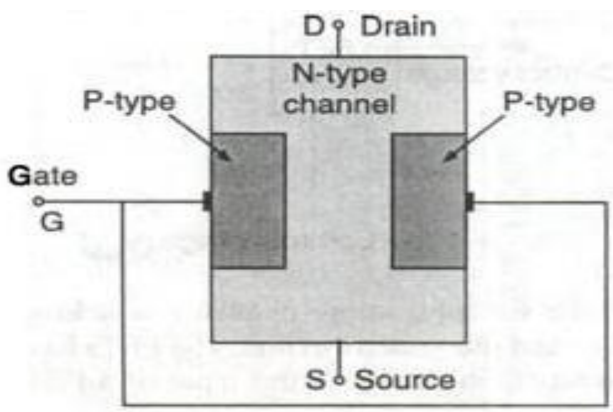
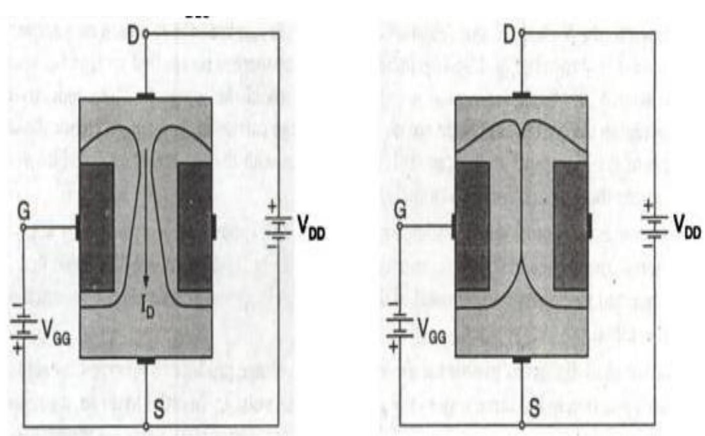
Explanation 2M

As the input voltage increases, the input current (I_S) increases. This increases the current through Zener Diode, without affecting the load current (I_L). The increase in input current will also increase the voltage drop across R_S and keeps V_L as constant. If the input voltage is deceased, the input current also decreases. As a result, the current through zener will also decrease. Hence voltage drop across series resistance will be reduced. Thus V_L and I_L remains constant.

Regulation with varying load resistance: (Load Regulation)

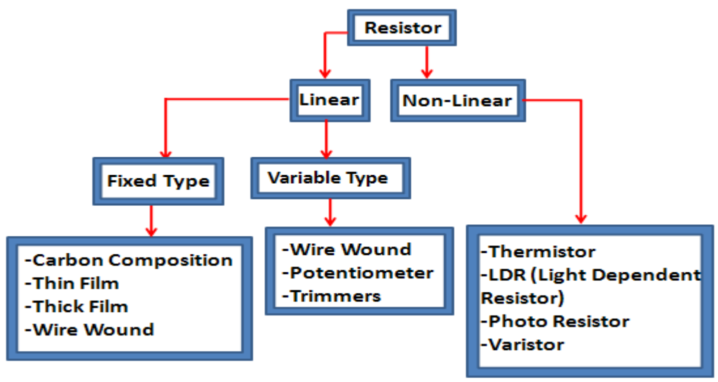
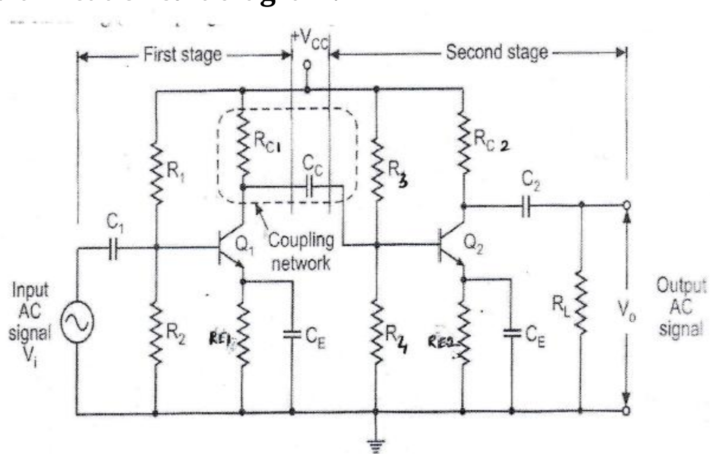
The variation in the load resistance R_L changes I_L, thereby changing V_L. When load resistance decreases, the load current increases. This causes zener current to decrease. As a result, the input current and voltage drop across R_S remains constant. Thus, the load voltage V_L is also kept constant. On the other hand, When load resistance increases, the load current decreases. This causes zener current to increase. This again keeps the input current and voltage drop across R_S constant. Thus, the load voltage V_L

		is also kept constant. Thus, a Zener diode acts as a voltage regulator and the fixed voltage is maintained across the load resistor R_L	
	(d) **Ans**	**Describe the working principle of npn transistor with the help of diagram.** **NPN Transistor:** **Diagram:**  **Working principle:** Above figure 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 I_E. 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 I_B. The remaining electrons (98%) cross over in to the collector region to constitute collector current I_C. 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. $$\mathbf{I_E = I_B + I_C}$$	**4M** ***Any other relevant diagram 2M*** ***Explanation 2M***

3		**Attempt any THREE:**	**12**
	(a)	**Sketch the construction of n-channel JFET and explain its working principle.**	**4M**
	Ans	**Construction of N-channel JFET** 	***Construction 2M***
		Working of N channel FET  When a voltage is applied between the drain and source with a DC supply (V_{DD}), the electrons flows from source to drain through narrow channel existing between the depletion regions. This constitutes drain current ,I_D. The value of drain current is maximum when the external voltage applied between gate and source 0V.	***Working Principle 2M***

		When the gate to source voltage (applied by V_{GG})is increased above zero, the reverse bias voltage across gate source junction is increased. The depletion region is widened. This reduces the width of the channel and thus controls the flow of current. The gate source voltage reaches a point where the channel gets completely blocked and the drain current becomes zero is called pinch- off voltage	
	(b)	**Differentiate active and passive transducer on the basis of any four points.**	**4M**
	Ans	(see table below)	***Any four Comparison 1M each***
	(c)	**State the different types of resistors. State any four specifications of resistors.**	**4M**

Parameters	**Active Transducer**	**Passive Transducer**
Working Principle	Operate under energy conversion principle	Operate under energy controlling principle
Example	Thermocouple, Piezoelectric Transducer etc.	Thermistors, Strain Gauges etc.
Advantage	Do not require external power supply for its operation	Require external power supply for its operation
Application	Used for measurement of Surface roughness in accelerometers and vibration pick ups	Used for measurement of power at high frequency

	Ans	**Different types of Resistors:-**  **Specifications of Resistor:-** • Temperature Coefficient. • Size or value of a resistor • Power Dissipation / wattage • Tolerance • Thermal Stability • Frequency Response. • Power De-rating. • Maximum Temperature. • Maximum Voltage.	***Classification 2M*** ***Any four Specifications of resistors 2M***
	(d) **Ans**	**Explain the working of two stages RC coupled amplifier with neat circuit diagram.**  	**4M** ***Diagram 2M***

		Two stages are connected with R & C components so it is called as RC Coupled amplifier. a) Resistor R_{C1}, R_3 & Capacitor C_C form the coupling network. b) R_1, R_2 , R_3, R_4 provide voltage divider bias to Q_1 & Q_2. c) R_{C1}& R_{C2} provide V_{CE} to Q_1 & Q_2. d) R_{E1} & R_{E2} provide bias stabilization. **Applications of RC Coupled Amplifier:** Excellent frequency response from 50 Hz to 20 KHz so it is very useful in the initial stage of all public address systems.	***Working with applications 2M***
4		**Attempt any THREE:**	**12**
	(a)	**Explain any four selection criteria of transducers for temperature measurement.**	**4M**
	Ans	***Note: Any other relevant selection criteria shall be considered.*** 1. Ambient temperature range: It will impact on sensor accuracy as we can easily predict the ambient temperature effect on measurement taken from the sensor. 2. Stability & control precision requirement: If accuracy requirement is far better than 20F, use an RTD and if long term stability is required an RTD is better choice than Thermocouple. 3. Speed of response to temperature change requirement. Spring loaded temperature sensor and stepped thermo wells provide good speed of response. 4. Cost: Measurement failure most often results in production down time costs.	***Any four Correct selection criteria of transducers 1M each***
	(b)	**Differentiate between P-N junction diode and zener diode.**	**4M**

	Ans	see comparison table below	***Any four Correct Comparison 1M each***

Sr.No.	PN Junction Diode	Zener Diode
1	It is not properly doped to control reverse breakdown.	It is properly doped to control reverse breakdown.
2	It conducts only in one direction.	It conducts in both directions.
3	It is always operated in forward-bias condition.	It is always operated in reverse-bias condition.
4	It has no sharp reverse breakdown.	It has quite sharp reverse breakdown.
5	It burns immediately, if applied voltage exceeds the breakdown voltage.	It will not burn, but functions properly in breakdown region.
6	It is commonly used for rectification purpose.	It cannot be used for rectification, but commonly used for voltage regulation.

(c) **Draw DC load line of transistor. Explain working of transistor as a switch.** **4M**

Ans

DC loadline 2M

Transistor as a switch 2M

1. Q-point is the operating point of the transistor (I_{CQ}, V_{CEQ}) at which it is biased.

2. The concept of Q-point is used when transistor act as an amplifying device and hence is operated in active region of input output characteristics.

3.To operate the BJT at a point it is necessary to provide voltages and currents through external sources.

4.To draw DC load line of a transistor we need to find the saturation current and cutoff voltage.

The saturation current is the maximum possible current through the transistor and occurs at the point where the voltage across the collector is minimum.

5. The cutoff voltage is the maximum possible voltage across the collector and occurs at zero collector current.

A common emitter amplifier is shown the figure below:

Applying KVL to the collector circuit,

V_{CC}-V_{CE} - I_C.R_C=0

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Rearranging this equation we get,

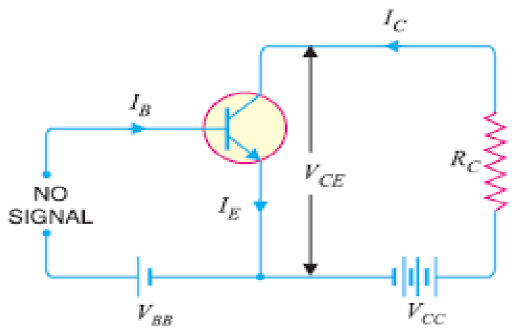
$I_C = (-1/RC).V_{CE} + (V_{CC}/R_C)$

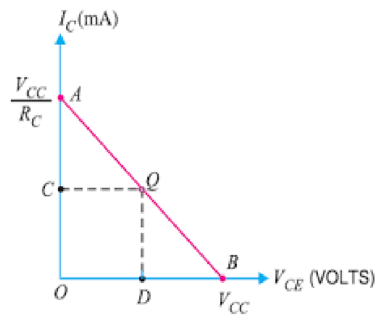
Compare the above equation with equation of a straight line ie.y=mx+c

Substituting $V_{CE}=0$, we get $I_C=V_{CC}/R_C$

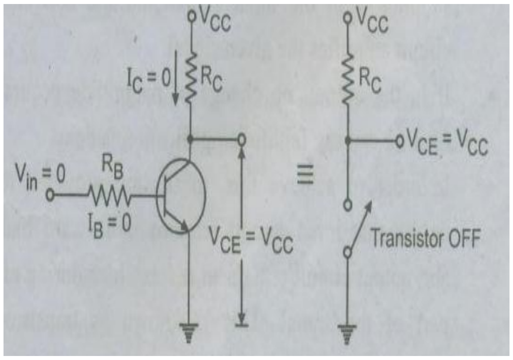
Substituting $I_C=0$, we get $V_{CE}=V_{CC}$

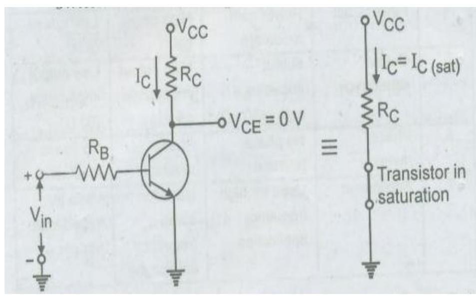
This straight line is called as DC load line

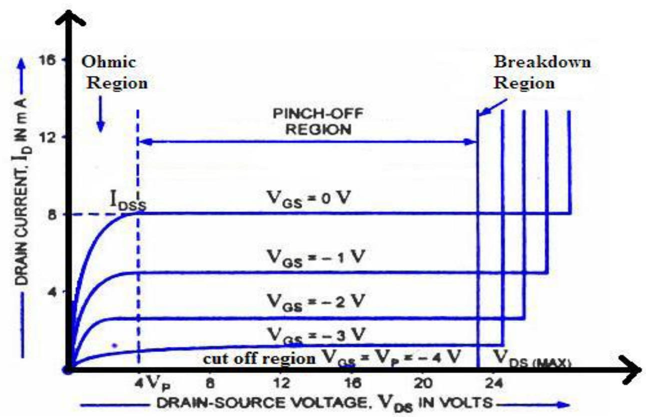


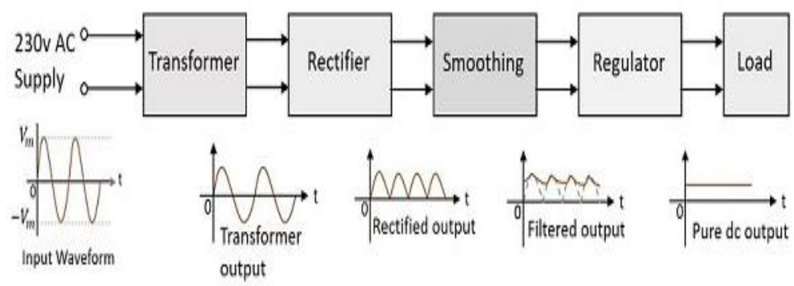
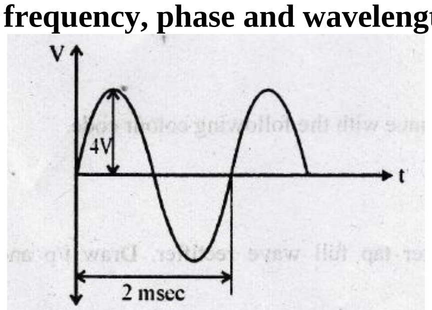


Transistor as a switch:

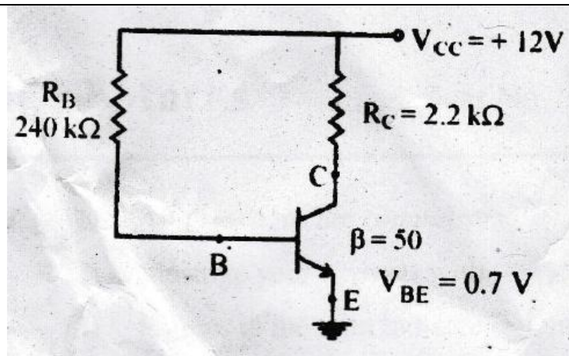


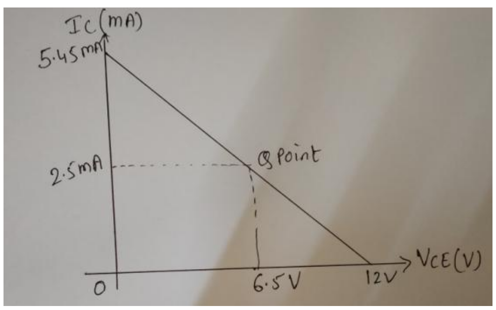
		1. Transistor in cut- off region is an open switch. Here V_{in} is 0 V. 2. In the cut –off region both the junction of a transistor are reverse biased and very small reverse current flows through the transistors. 3. The voltage drop across the transistor (V_{CE}) is high. Thus, in the cut off region the transistor is equivalent to an open switch as shown in figure.  In saturation the transistor is equivalent to a closed switch. When V_{in} 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 (VCE) is very small, of the order of 0.2 V to 1V depending on the type of transistor and collector current is very large.	
	(d)	**Draw the Drain characteristics of JFET showing different operating regions. If drain current is 5mA, I_{DSS} = 10mA & Vas $_{(off)}$ = -6V. Find the value of V_{as}.** ***Note: V_{as} is considered as V_{GS}***	**4M**

	Ans.	**Drain characteristics of JFET**  Given: $I_D = 5mA$ $I_{DSS} = 10mA$ $V_{GS(OFF)} = -6V$ $V_{GS} = ?$ $I_D = I_{DSS} \cdot \left(1 - \frac{V_{GS}}{V_{GS\,(OFF\,)}}\right)^2$ $V_{GS} = \left(1 - \frac{\sqrt{I_D}}{\sqrt{I_{DSS}}}\right) X\, V_{GS\ OFF}$ $V_{GS} = \left(1 - \frac{\sqrt{5mA}}{\sqrt{10mA}}\right) X - 6$ **V_{GS}= - 1.75V**	***Drain characteristics of JFET 2M*** ***Numerical Calculations 2M***
	(e) **Ans.**	**Draw the block diagram of regulated power supply and explain the working of each block.** ***Note: Any other block diagram with similar blocks shall be considered*** The block diagram of a Regulated Power supply unit is as shown below.	**4M**

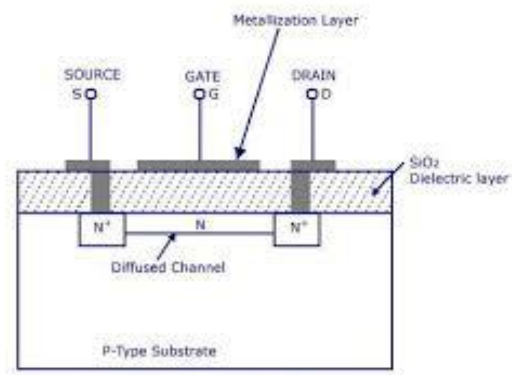
		 A typical Regulated Power supply unit consists of the following. **Transformer** − An input transformer for the stepping down of the 230v AC power supply. **Rectifier** − A Rectifier circuit to convert the AC components present in the signal to DC components. **Smoothing** − A filtering circuit to smoothen the variations present in the rectified output. **Regulator** − A voltage regulator circuit in order to control the voltage to a desired output level. **Load** − The load which uses the pure dc output from the regulated output.	***Diagram 2M*** ***Working of each block 2M***
5	**(a)**	**Attempt any TWO** **Solve the following:** **(i) In the waveform shown in fig (1), state its amplitude, frequency, phase and wavelength.**  **Fig. 1**	**12** **6M**

	Ans	From given figure, **1. Amplitude = Vm = 4V** **2. Frequency (f) =** $\frac{1}{T}$ $\frac{\mathbf{1}}{\mathbf{2\ x\ 10^{-3}}}$ **=500Hz** **3. Phase:** =0 **4. Wavelength λ = Vc/f =(3*10 ^8)/500 = 6 x 10^{5}m** **(ii) Define: amplitude and frequency** **Amplitude:** The maximum value (positive or negative) attained by an alternating quantity is called its amplitude or peak value. The amplitude of an alternating voltage or current is designated by V_m or I_m. **Frequency:** The number of cycles that occurs in one second is called the frequency (f) of the alternating quantity. It is measured in cycles/ sec or Hertz(Hz)	***Each formula ½M*** ***Each final answer ½M*** ***Each definition 1M***
	(b)	**(i) In the circuit shown in fig (2), a silicon transistor with β = 50 is used. Take V_{BE} = 0.7V. Find Q point value.**	**6M**

		 **Fig. 2**	
	Ans	**Collector current at saturation:** $I_{C(SAT)} = \frac{Vcc}{Rc}$ $I_{C(SAT)} = \frac{12}{2.2 \, x \, 10^3}$ $\mathbf{I_{C(SAT)} = 5.45 \, mA}$ Value of cut-off voltage: $\mathbf{V_{CE(cutoff)} = V_{CC}}$ Therefore, $\mathbf{V_{CE(cutoff)} = 12V}$ Base current , $I_B = \frac{Vcc}{RB}$ $I_B = \frac{12}{240 \, x \, 10^3}$ $\mathbf{I_B = 50 \, \mu A}$ **Collector current,** $I_C = \beta * I_B$ $I_C = 50 * 50 * 10^{\wedge -6}$ $\mathbf{I_C = 2.5 \, mA}$	***Each correct formula ½ M*** ***Each correct answer ½ M***

		Collector to emitter voltage , $V_{CE} = V_{CC} - (I_C * R_C)$ $V_{CE} = 12- (2.5 * 10^{-3} * 2.2*10^3)$ $\mathbf{V_{CE} = 6.5\ V}$ **Q-points are** $\mathbf{I_{CEQ} = 2.5\ mA}$ $\mathbf{V_{CEQ} = 6.5\ V}$ Q-point is located on the D.C. load line as shown in figure. 	
		(ii) Define operating point of the transistor. **Operating point:** For proper operation of a transistor, in any application, we set a fix level of certain currents and voltages in a transistor. These values of currents and voltages define the point, at which transistor operates. This point is called operating points or quiscent points or Q points.	***Q point definition 1 M***
	(c) **Ans**	**In full wave bridge rectifier V_m = 10V, RL = 10KΩ. find out V_{DC}, I_{DC}, ripple factor and PIV.** **In full wave bridge rectifier:** **1.** $\mathbf{V_{DC} = 2V_m/\pi = 0.637 * V_m}$ Therefore, $\mathbf{V_{DC} = 0.637 * 10}$ $\mathbf{V_{DC} = 6.37\ V}$	**6M** ***Each formula 1M***

		2. $I_{DC} = 2I_m/\pi = \frac{2Vm}{\pi * RL}$ Therefore, $I_{DC} = \frac{2 \, x \, 10}{\pi \, x \, 10 \, x \, 10^3}$ **I_{DC} = 0.636 mA** **3. Ripple factor** $\sqrt{\frac{I_{rms-1}}{I_{DC}}} = \sqrt{\frac{I_{m/\sqrt{2}} - 1}{I_{DC}}}$ $\sqrt{\frac{V_m / _{RL \, x \, \sqrt{2} - 1}}{I_{DC}}}$ 7.07 x 10^{-4} Therefore, **Ripple factor = 0.331** **4. PlV = Vm** Therefore, **PIV= 10 V**	***Each final answer ½ M***
6	**(a)** **Ans**	**Attempt any TWO:** **Explain working principle of N-channel depletion type MOSFET with construction diagram. Compare depletion type MOSFET & enhancement type MOSFET.**	**12** **6M**



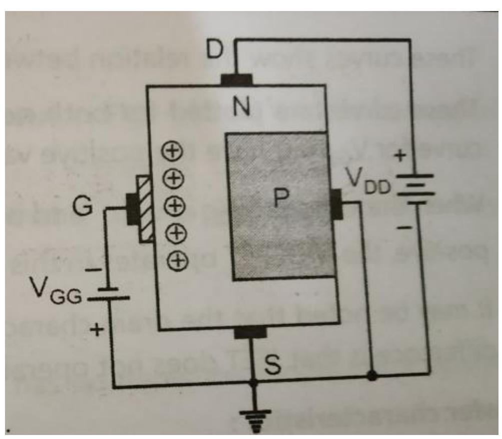
N-Channel DE-MOSFET Structure

Construction diagram 2M

Working principle:

The depletion type MOSFET can be operated in the following two ways:

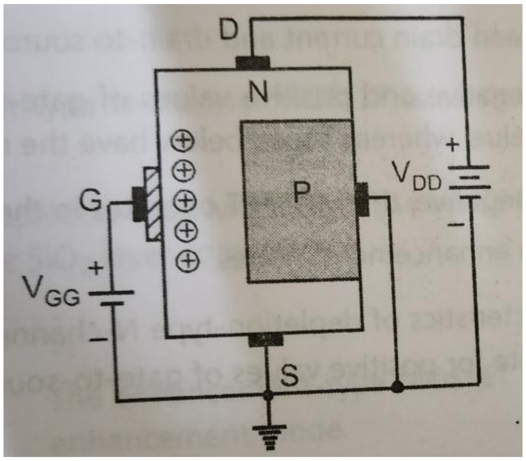
1. Depletion mode:



Working principle 2M

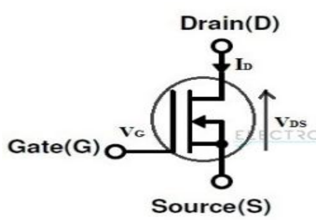
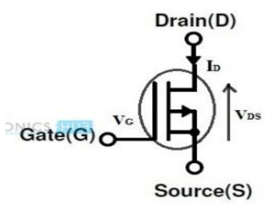
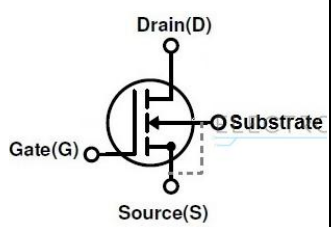
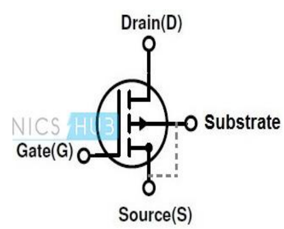
A depletion type N channel MOSFET with negative gate to source voltage is shown in figure. The negative gate voltage induces positive charges in N type channel through the insulating layer SiO2. Since, conduction of current through the N type channel is by means of majority carriers (i.e. electrons), the free electrons in the vicinity of positive charges are repelled away in the N type channel. This reduces the number of free electrons passing through the N type channel. As a result of this, the N type channel is depleted of free electrons(i.e. majority carriers). Thus, it reduces the drain current flowing through the N type channel as the gate to source voltage is made more negative. As large negative gate to source voltage, the N type channel region near the drain end is totally depleted of free electrons and therefore the drain current reduces to zero.

2. Enhancement mode:



An enhancement type N channel MOSFET with positive gate to source voltage is shown in figure. The positive gate voltage induces negative charges in N type channel through the insulating layer SiO2. Since, conduction of current through the N type channel is by means of majority carriers(i.e. electrons), the free electrons in the vicinity of positive charges are added together in the N type channel. Thus, the positive gate voltage increases the number of free electrons passing through the N type channel. This increases the drain current flowing through the N type channel as a result, it enhances the conductivity of the N channel. Thus, it increases the drain current flowing through the N type channel as the gate to source voltage become more positive. Because of the fact, the positive gate operation is called an enhancement mode.

Comparison of Depletion type MOSFET & Enhancement type MOSFET

Sr. No.	Depletion type MOSFET	Enhancement type MOSFET
1	 N-Channel  P- Channel	 N- Channel  P- Channel
2	An insulating oxide layer is present between gate and channel.	An insulating oxide layer is present between gate and substrate.
3	N or P type channel is present**.**	N or P type channel is not present**.** At a time of operation, induced channel is created.
4	For N channel V_{GS} = negative (for depletion mode) V_{GS} = positive (for enhancement mode)	For N channel V_{GS} = only positive
5	For N-channel, If V_{GS} is more negative, drain current decreases more.	For N-channel, If V_{GS} is more positive, drain current increases more.

Comparison on Any four points 2M

	(b)	**Differentiate CE, CB, CC, w.r.t. to** **(i) Input resistance** **(ii) Output resistance** **(iii) Current gain** **(iv) Voltage gain** **(v) Phase shift between input and output** **(vi) Applications**	**6M**
	Ans	(see table below)	***Each point 1M***

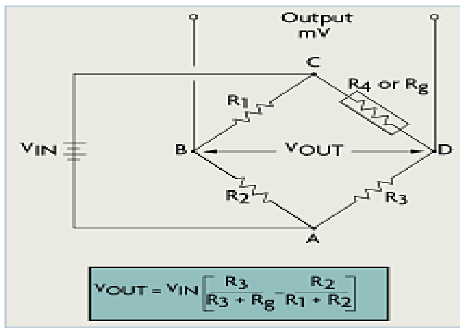
Sr. No	**Parameter**	**CB**	**CE**	**CC**
1	Input resistance	Very low (20Ω)	Low(1K Ω)	High (500K Ω)
2	Output resistance	Very high (1M Ω)	High(40K Ω)	Low(50 Ω)
3	Current gain	Less than unity	High (20 to few hundred)	High (20 to few hundred)
4	Voltage gain	Medium	Medium	Less than unity
5	Phase shift between input and output	0	180°	0
6	Application s	As pre-amplifier	As Audio amplifier	For impedance matching

	(c)	**List four types of electrical pressure transducers and describe one application of each one.** **Note: *½M may be granted for stating the application of each electrical pressure transducer without description.***	**6M**
	Ans	**Types of electrical pressure transducers:** 1.Strain gauge pressure transducers 2.Potentiometer pressure transducers 3.Piezoelectric pressure transducers 4. Reluctance pressure transducers 5. Capacitive pressure transducers	***Any four Types 2M***

Applications:

1.Strain gauge pressure transducers

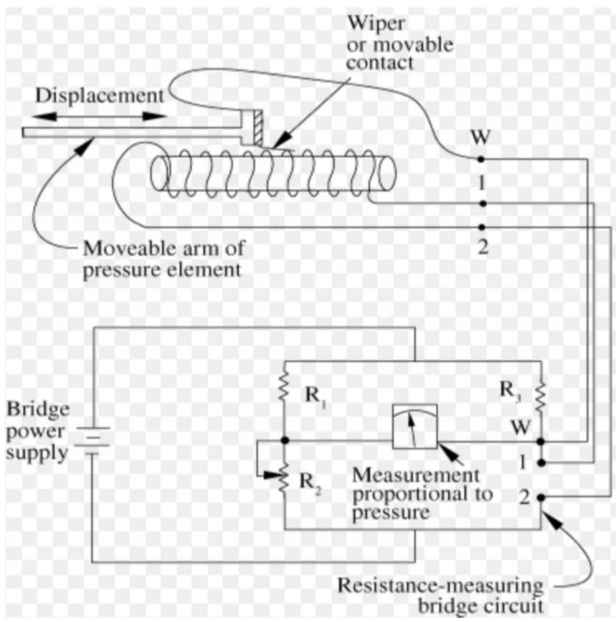
In measurement of strain



In order to measure strain with a bonded resistance strain gauge, it must be connected to an electric circuit that is capable of measuring the minute changes in resistance corresponding to strain. Strain gauge transducers usually employ four strain gauge elements that are electrically connected to form a Wheatstone bridge circuit. The Figure shows a typical strain gauge diagram. A Wheatstone bridge is a divided bridge circuit used for the measurement of static or dynamic electrical resistance. The output voltage of the Wheatstone bridge is expressed in millivolts output per volt input. The Wheatstone circuit is also well suited for temperature compensation. The number of active strain gauges that should be connected to the bridge depends on the application. For example, it may be useful to connect gauges that are on opposite sides of a beam, one in compression and the other in tension. In this arrangement, one can effectively double the bridge output for the same strain. In installations where all of the arms are connected to strain gauges, temperature compensation is automatic as resistance change (due to temperature variations) will be the same for all arms of the bridge.

Any one Application of each type 1M

2.Potentiometer pressure transducers
In pressure measurement:



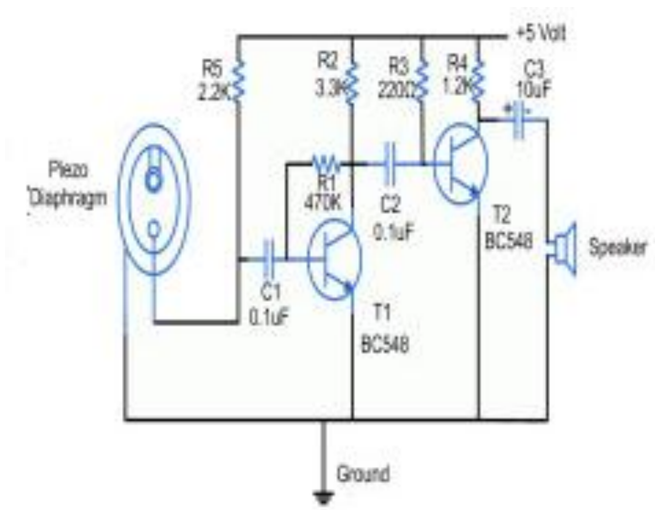
A potentiometric consists of a wire wound resistor with removable slide attached to it. Moving the slide will change the amount of resistance of the potentiometer. When the potentiometer is connected in an electronic circuit any movement of the slide on the potentiometer will change the resistance in the circuit. The circuit configuration most often used to make accurate measurement is the Wheatstone bridge.

In a Wheatstone bridge, the bridge has two parallel legs. Each leg has two resistors in series. A voltage source has connected to the bridge so that current will follow through each leg. In a typical bridge, there is another circuit installed here. When the resistance of all four resistor is exactly equal the current flow through each leg is equal. In this condition, the bridge is balanced. However, if one of these resistors is changed, current flow through each leg is no longer equal.

3. Piezoelectric pressure transducers

In detection of audio signal

The following circuit shows the piezoelectric sensor circuit diagram. The components required for this circuit are four resistors, speaker, two NPN transistor, capacitor, and piezo diaphragm. The generation of the electrical signal in the piezo diaphragm is when it is subjected to the pressure variation due to the sound in the vicinity. The output of the piezo-diaphragm is supplied to the two transistors of T1 & T2 (BC548) and the two transistors are known as a Darlington pair, it has a very high current.



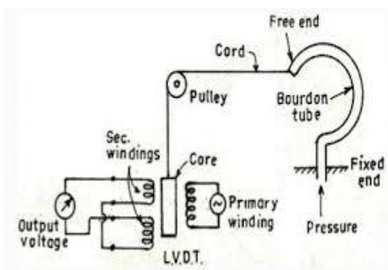
Circuit Diagram of Piezoelectric Sensor

If piezo diaphragm receives any audio signals, in the opposite faces it produces the voltage difference. By using the capacitors C1 of 0.1µF the signal is filtered or a DC component. The first transistor T1 of the Darlington pair amplifiers of the input signal and the output appears at the resistor R2. For the transistor T1, base-collector bias is given by the resistor R1 of 470k. The output of the first transistor T1 is given to the base of the T2 transistor after it is filtered by another capacitor C2.

In further the output of the transistor T1 is amplified by the transistor T2 and at the resistor R4, the amplified signal is produced. The R3 resistor is used for the necessary bias for the transistor T2. The output of the second transistor T2 is filtered with the capacitor C3 and it is connected to the speakers.

4. Reluctance pressure transducers

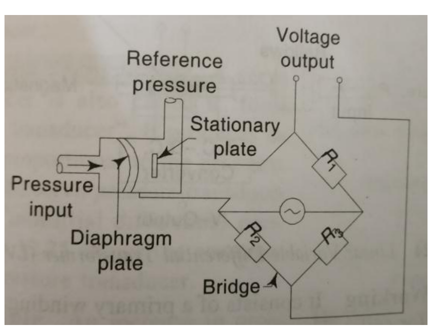
Measurement of fluid pressure in bourdon tube:



In this the, the bourdon tube act as primary transducer and LVDT which follows the output of bourdon tube act as a secondary transducer. The bourdon tube senses the pressure when liquid enters into it, it will bend depending upon the pressure of the fluid and converts it into a displacement. This set up is used for measurement of pressure which is converted into electrical signal by LVDT.

5. Capacitive pressure transducers

Measurement of pressure in pipe



		In this arrangement, in place of movable plate, diaphragm is used, which expands and contracts due to change in pressure. The diaphragm plate acts as a movable plate of a capacitor. A fixed plate is placed near the diaphragm. These plates form a parallel plate capacitor which is connected as one of the arms of a bridge. Any change in pressure causes a change in distance between the diaphragm and fixed plate, which is unbalances the bridge. The voltage output of the bridge corresponds to the pressure applied to the diaphragm plate.	