

[Answer any *two* questions from **Group-A** and any *three* questions from **Group-B**;
 Separate answer script must be used for Group-A and Group-B.]

Group-A

- a) What is transistor? Why is it so called? 0
- b) What do you understand by transistor biasing? What are the commonly used biasing techniques? 0
- c) Draw the circuit diagrams for common base (CB), common emitter (CE), and common collector (CC) configurations. 0
- d) Explain the operation of an n-p-n transistor with proper diagram. 02

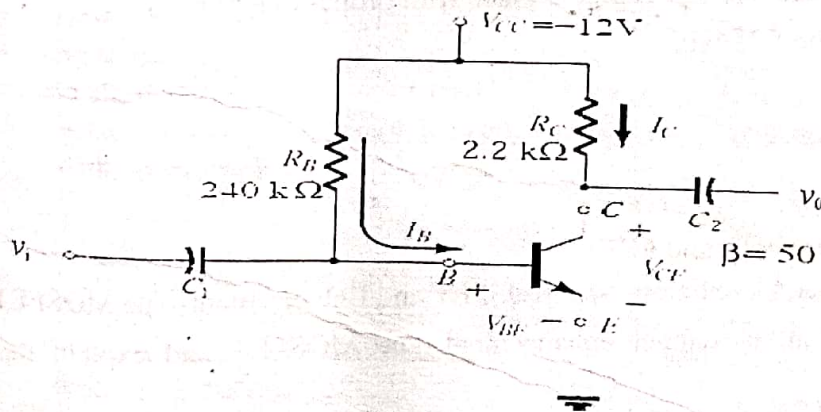
- a) Establish following relationship: 03

$$i) \quad I_C = \frac{\alpha}{1-\alpha} I_B + \frac{1}{1-\alpha} I_{CBO}$$

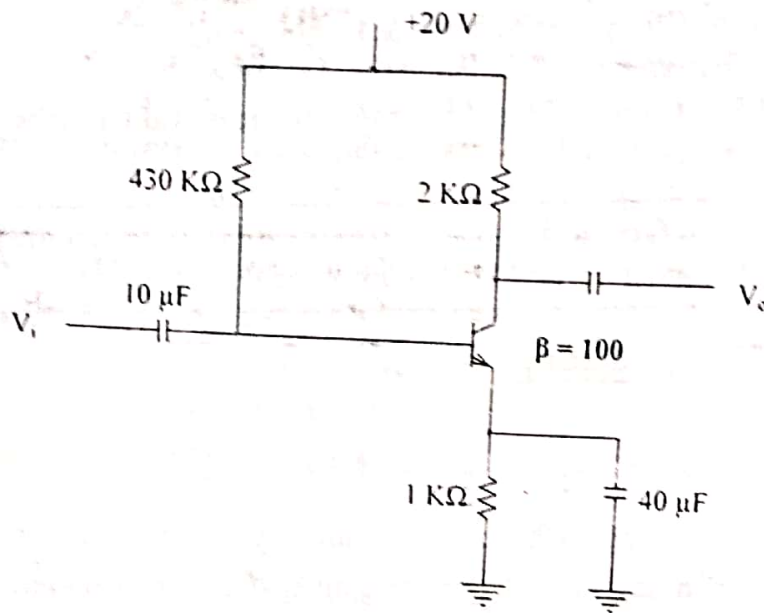
$$ii) \quad \beta = \frac{\alpha}{1-\alpha}$$

Where the symbols have their usual meanings.

- b) Draw the common emitter configuration of a BJT and explain its operation with proper input and output characteristic curve. 04
 - c) Describe the operation of a transistor as an amplifier. 03
- a) Define load line of a BJT. 02
 - b) Determine the dc bias voltage V_{CE} and the current I_C for the given biasing circuit. 04



c) For the following network, determine I_B , I_C , and V_{CE}



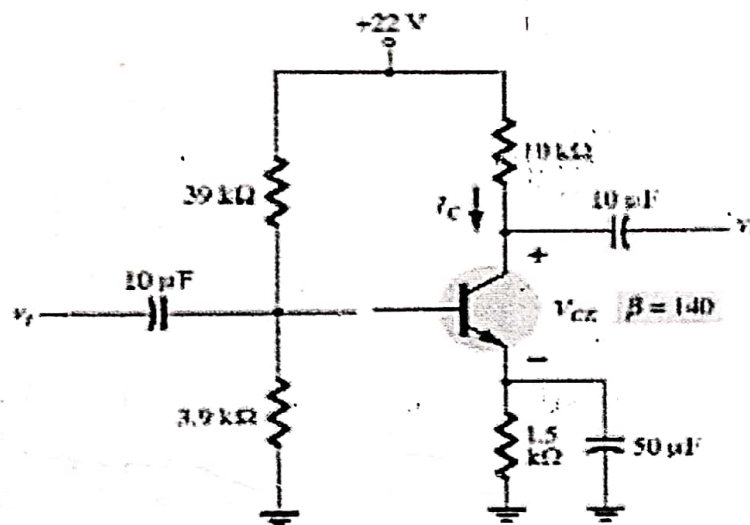
Group-B

4.
 - a) What is FET? How many types of FET are available?
 - b) Describe the construction and working principle of an n-channel JFET.
 - c) Sketch the transfer characteristics for an n-channel depletion-type MOSFET with $I_{DSS} = 12 \text{ mA}$ and $V_P = -4 \text{ V}$.
5.
 - a) What is OPAMP? Write down the application of OPAMP.
 - b) Deduce the expression of gain for a negative feedback non-inverting amplifier.
 - c) Draw the configuration of a summing amplifier and explain how it works.
6.
 - a) What is SCR? Explain its current-voltage characteristics with proper diagram.
 - b) Write short note any one of the following
 - i) DIAC
 - ii) UJT
7.
 - a) What are the difference between BJT and FET?
 - b) What are the differences between Depletion-type MOSFET and Enhancement-type MOSFET?
 - c) Draw basic construction of an n-channel enhancement-type MOSFET and explain its basic operation and characteristics.

[Answer any *two* questions from **Group-A** and any *two* questions from **Group-B**;
 Separate answer script must be used for Group-A and Group-B.]

Group-A

- 1.a) What is Transistor? Draw the circuit diagram of Common Base (CB), Common Emitter (CE) and Common Collector (CC) configurations. 6.5
- b) Explain the working principle of a common emitter NPN transistor with proper sketch and find its input output characteristics. 06
- 2.a) What do you mean by biasing of a BJT? What are the techniques used for biasing? Briefly explain one of them with proper sketch. 06
- b) Determine the dc bias voltage V_{CE} and the current I_C for the voltage divider biasing circuit. 6.5

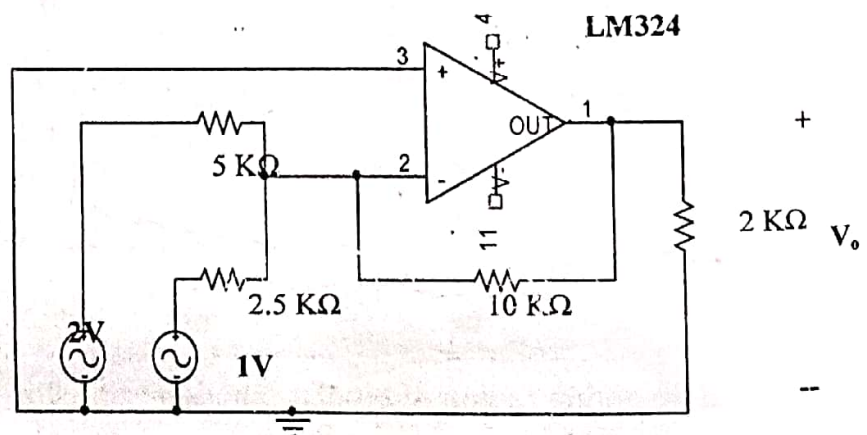


- 3.a) Explain the different operating region of bipolar junction transistor. 6.5
- b) Deduce the relations form the common emitter BJT configuration. 06
 - i) $\beta = \frac{\alpha}{1 - \alpha}$
 - ii) $\alpha = \beta * \gamma$

Where the symbols are as usual meaning.

Group-B

- 4.a) Construct an Enhancement type MOSFET; explain its working principle with proper sketch
- b) Find the transfer characteristics curve of an n-channel Depletion type MOSFET.
Given that, $I_{DSS} = 8\text{mA}$ and $V_P = -6\text{V}$.
- 5.a) Define Operational Amplifier? Why it is called operational Amplifier? Draw the ideal and practical equivalent circuit of an OP-AMP.
- b) Derive the output voltage relation of an inverting OPAMP.
- c) Define CMRR and Common mode input and Differential mode input
- 6.a) What point should be considered in the design of SCR gate signal?
- b) Define the following term from the SCR characteristics curve:
i) Blocking State
ii) On State
iii) Holding Current & Latching Current
iv) Break over Voltage.
- c) Write short note on UJT or TRIAC.
- 7.a) Differentiate between a DMOS and EMOS.
- b) From the given OPAMP, find the output and gain.



- c) Describe the basic principle of JFET with input output wave form.

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Final Examination, Spring-2015

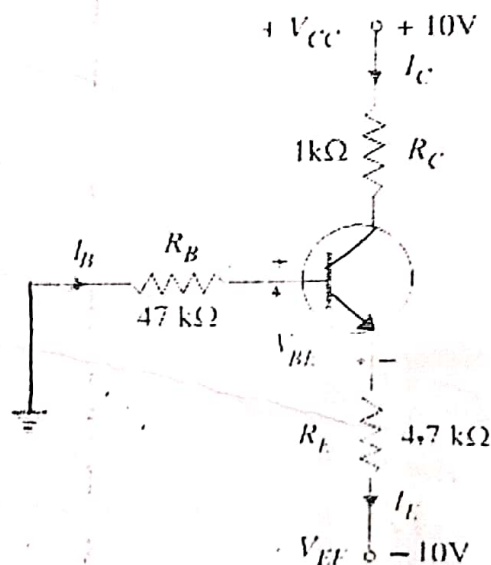
Course Code: EEE1205 Course Title: Electronics Devices & Circuits.

Total marks: 50 Time: 2 hour 30 min

[Answer any *two* questions from Group-A and any *three* questions from Group-B;
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Group-A

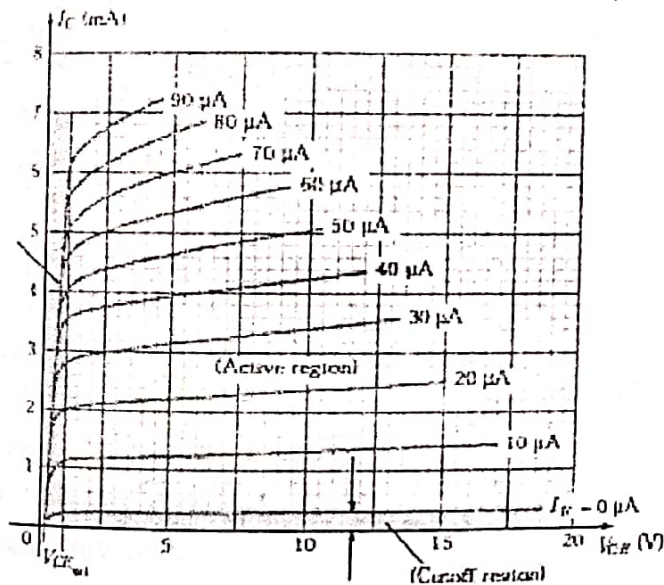
- 1.a) What is transistor? Why it is called so? 02
- b) Explain the working principle of NPN transistor with neat diagram. 04
- c) Explain with circuit diagram how a common emitter NPN transistor can act as an amplifier. 04
- 2.a) Draw only the all possible types of transistor configurations using both PNP & NPN transistors. 03
- b) What is α & β ? Find the relation between them. 02
- c) Derive the equation, $I_C = \beta I_B + I_{CEO}$,
Where the symbols carry their usual meaning. 03
- d) Draw the input and output characteristics of a transistor in CE connection. 02
- 3.a) Explain the term Cut off point, Saturation point and Active region along with proper graphical representation. 03
- c) Determine the Q point of the transistor circuit shown in figure. Also draw the dc load line. Given $\beta=120$, $V_{BE}=0.7V$ 05



- b) What is operating point? Point out the operating point in the load line diagram.
- 4.a) What is faithful amplification? Explain the conditions to be fulfilled to achieve faithful amplification in a transistor amplifier.
- b) What is stability factor? Derive the expression for stability factor.
- c) Describe the potential divider method in detail. How stabilization of operating point is achieved by this method.
5. a) What is multistage transistor amplifier? Draw the circuit diagram of RC coupled transistor amplifier and explain its operation.
- b) Draw the frequency response curve of RC coupled amplifier and explain why it depicts steady gain in mid frequency range?
- c) Write the advantages and disadvantages of RC coupled amplifier.
6. a) What is JFET? Describe the difference between JFET & BJT.
- b) Why the input impedance of JFET is more than that of the transistor?
- c) Explain the circuit operation of n-channel depletion types MOSFET in both depletion and enhancement mode.
- 7.a) What is SCR? Explain the working principle of SCR.
- b) Draw the I-V characteristics of SCR.
- c) Explain the action of SCR as a switch. What are the advantages of SCR switch over mechanical switch?
- d) How does SCR differ from an ordinary rectifier?

Group-A

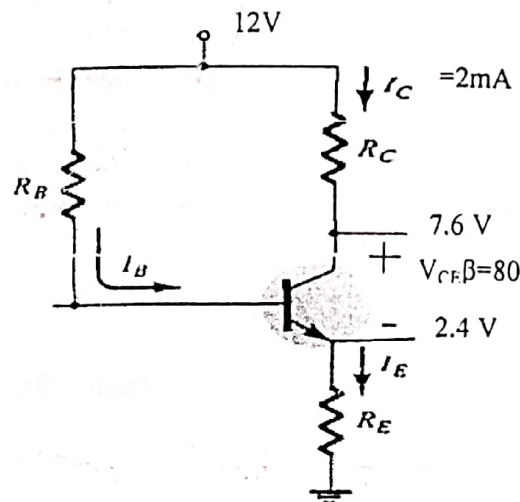
- 1.a) What is transistor? 01
- b) Draw the circuit diagrams for CB, CE, CC configurations with proper biasing. 03
- c) Draw the input and output characteristics curve for common emitter configuration and explain properly. 04
- d) Find I_E if $I_B = 40\text{mA}$ and α_{dc} is 0.98. 02
- 2.a) Explain the three terminals of a bipolar junction transistor. 02
- b) Explain one type of transistor biasing technique. 05
- c) Using the characteristic curve find I_C and β at $I_B = 30\mu\text{A}$ and $V_{CE} = 7.5\text{ V}$. 03



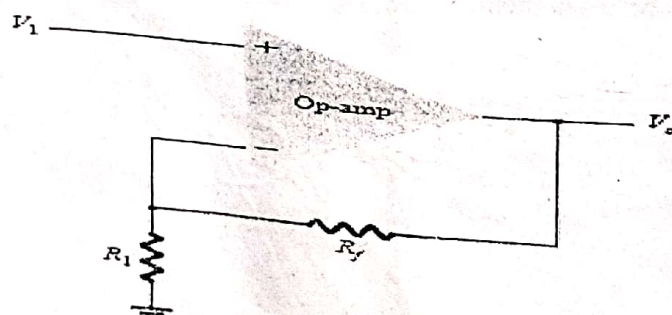
- 3.a) What are the differences among Base, Emitter and Collector in the light of doping level? 02
- b) What is α & β ? Find the relation between them. 03

- c) Given the information provided in Figure determine:
 R_C, R_E, R_B, V_{CE}

05



- 4.a) What is FET? How many types of FET are available? 02
- b) Draw the construction diagram of depletion type MOSFET and explain its operation with transfer characteristic curve. 05
- c) Sketch the transfer characteristics for an n -channel depletion-type MOSFET with $I_{DSS} = 12 \text{ mA}$ and $V_p = -6 \text{ volt}$. 03
5. a) What is SCR? Explain the characteristics of SCR. 03
- b) Differentiate among TRIAC and DIAC. 02
- c) Write short note on UJT. 05
6. a) Define Operational Amplifier. 01
- b) What are inverting and non-inverting amplifiers? 03
- c) Describe how an operational amplifiers act as summer. 04
- d) Find the output voltage of an OP-AMP inverting adder for the following sets input voltages and resistors. In all cases, $R_f = 1\text{M}$. Where, $v_1 = -3\text{V}$, $v_2 = +3\text{V}$, $v_3 = +2\text{V}$; $R_1 = 250 \text{ K}$, $R_2 = 500 \text{ K}$, $R_3 = 1\text{M}$. 02
- 7.a) Explain the circuit operation of n -channel enhancement type MOSFET. 05
- b) How TRIAC control AC where SCR control only DC? 02
- c) If the input voltage, $V_i = 5.7\text{V}$ and $R_f = R_i$, what will be the output of the given OPAMP? 03



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[Answer any *two* questions from **Group-A** and any *three* questions from **Group-B**;
 Separate answer script must be used for Group-A and Group-B.]

Group-A

- | | |
|--|----|
| What is transistor? Why it is called so? | 02 |
| Explain the working principle of NPN transistor with neat diagram. | 04 |
| Draw the input and output characteristics curve for common emitter configuration and explain properly. | 04 |
| Discuss the condition of biasing of a BJT. What are the techniques used for biasing? Briefly explain the voltage divider biasing technique with proper sketch. | 05 |
| Determine the dc bias voltage V_{CE} and the current I_C for the emitter bias circuit in Figure 2(b). | 05 |

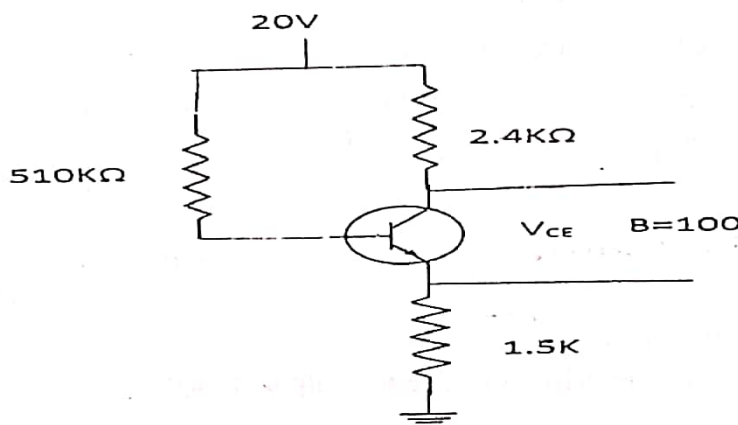


Figure 2(b)

- | | |
|--|----|
| Explain the load line of a bipolar junction transistor. | 02 |
| Derive the equation $I_c = \beta I_b + I_{cEO}$ Where the symbols carry their usual meaning. | 04 |
| What are α and β ? Find the relation between them. | 02 |
| Explain how a transistor act as an amplifier? | 02 |

Group-B

- 4.a) Draw basic construction of an n-channel enhancement type MOSFET and explain its basic operation and characteristics.
- b) Sketch the transfer characteristics for an n-channel depletion types MOSFET with $I_{DSS} = 12\text{mA}$ and $V_p = -6\text{V}$.
- 5.a) What is OPAMP? Why it is called operational Amplifier? Draw the ideal and practical equivalent circuit of an OP-AMP.
- b) Derive the output voltage equation of an inverting OPAMP.
- c) What are the basic features of operational Amplifier?
- 6.a) What point should be considered in the design of SCR gate signal?
- b) What is SCR? Explain its current-voltage characteristics with proper diagram.
- c) Write Short note on any of the followings:
- i) DIAC
 - ii) UJT
- 7.a) Differentiate between a BJT and FET.
- b) A summing OPAMP shown in Figure 7(b). Calculate the output voltage.

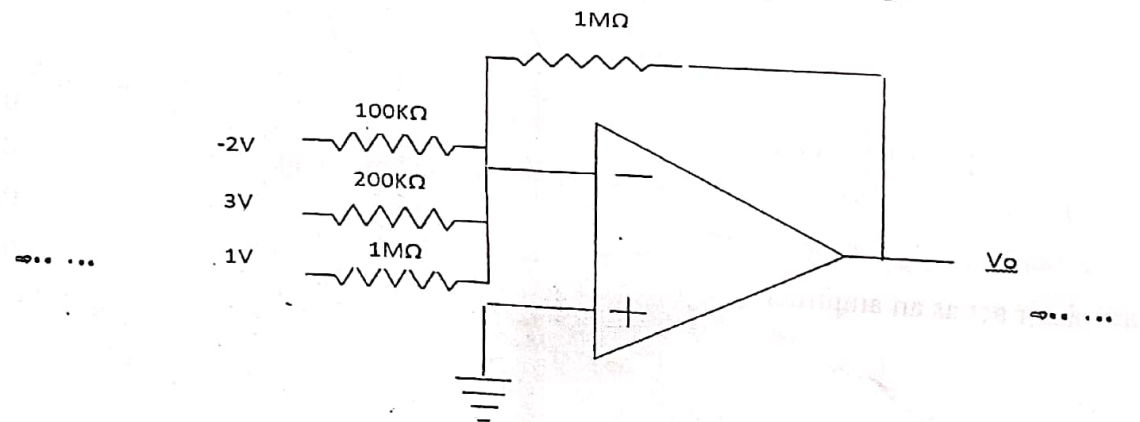


Figure 7(b)

- c) Describe the basic principle of JFET with input output wave form.

[Answer any *two* questions from **Group-A** and any *three* questions from **Group-B**;
Separate answer script must be used for Group-A and Group-B.]

Group A

- | | | |
|-------|---|----|
| 1.(a) | What do you mean by transistor? | 02 |
| (b) | "Transistor act as an Amplifier" Explain. | 03 |
| (c) | Draw the input and output characteristics of common emitter configuration and explain briefly. | 05 |
| | | |
| 2.(a) | What is current amplification factor, β ? | 01 |
| (b) | Establish the following relation:
(i) $I_E = (\beta + 1)I_B + (\beta + 1)I_{CBO}$
(ii) $\beta = \frac{\alpha}{1 - \alpha}$ | 04 |
| (c) | What do you mean by faithful amplification? Describe the conditions of faithful amplification with proper circuit arrangement. | 05 |
| | | |
| 3.(a) | Explain voltage divider bias method of transistor biasing. Also develop the mathematical expression for collector current and collector-emitter voltage for voltage divider bias. | 05 |
| (b) | Describe d.c. and a.c. load line for a transistor with proper circuit arrangement. | 05 |

Group B

- | | | |
|-------|--|----|
| 4.(a) | Write down the differences between JFET and BJT. | 02 |
| (b) | Depict the output characteristics of JFET. | 05 |
| (c) | A JFET has the following parameters: $I_{DSS} = 32 \text{ mA}$; $V_{GS(\text{off})} = -8 \text{ V}$; $V_{GS} = -4.5 \text{ V}$. Find the value of drain current. | 03 |
| | | |
| 5.(a) | Describe the operating principle of n-channel enhancement type MOSFET. | 05 |
| (b) | Draw the input and output characteristics of p-channel depletion type MOSFET. | 02 |
| (c) | For a certain D-MOSFET, $I_{DSS} = 10 \text{ mA}$ and $V_{GS(\text{off})} = -8 \text{ V}$.
(i) Is this an n-channel or a p-channel?
(ii) Calculate I_D at $V_{GS} = -3 \text{ V}$.
(iii) Calculate I_D at $V_{GS} = +3 \text{ V}$. | 03 |
| | | |
| 6.(a) | Write short note on: (Any four)
(i) Thermistor, (ii) UJT, (iii) Diac, (iv) Triac and (v) SCR. | 10 |
| 7.(a) | Illustrate the operating principle and frequency response of RC-coupled amplifier. | 05 |
| (b) | Derive an expression for voltage gain for inverting and non-inverting amplifiers. | 05 |

[Answer any *two* questions from Group-A and any *three* questions from Group-B;
Separate answer script must be used for Group-A and Group-B.]

Group-A

What is FET? How many types of FET are available?

What is JFET? Describe its construction and working principle (N-Channel JFET).

A JFET has the following parameters: $I_{DSS} = 22 \text{ mA}$; $V_{GS(off)} = -6 \text{ V}$; $V_{GS} = -3.5 \text{ V}$. Find out the value of drain current.

What is switching circuit? Write down the classification of it.

Explain the switching action of transistor with proper diagram in

- i) OFF region
- ii) ON region

A transistor is used as switch. If $V_{CC} = 10 \text{ V}$; $R_C = 1 \text{ k}\Omega$ and $I_{CBO} = 10 \text{ }\mu\text{A}$, determine the value of V_{CE} when the transistor is (i) cut off (ii) saturated.

Why FET is called Voltage-controlled device? Explain your answer with proper diagram.

What are the applications of monostable multivibrator? Explain its working principle.

What is electro-mechanical switch or relay. Explain the working principle of relay with proper diagram.

Group-B

What is operational amplifier? Write down the applications of operational amplifier.

Explain how an Op-Amp can be used as an integrator amplifier.

For Fig. 1, let $R_f = 250 \text{ k}\Omega$, $R_i = 10 \text{ k}\Omega$, and $E_i = -0.5 \text{ V}$. Calculate :

- i. I_o ;
- ii. The voltage across R_f ;
- iii. V_o .

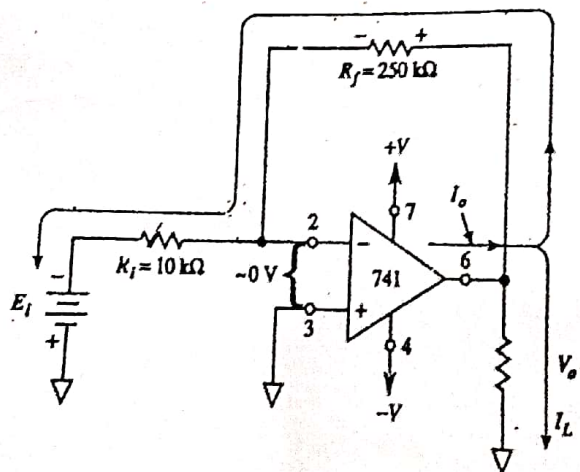


Fig-1

- 5.a) What is negative feedback?
- b) Explain the principle of negative feedback in amplifier.
- c) Show that the negative current feedback increases the output impedance of an amplifier.
- d) When negative voltage feedback is applied to an amplifier of gain 100, the overall gain falls to 50.
- (i) Calculate the fraction of the output voltage feedback.
 - (ii) If this fraction is maintained, calculate the value of the amplifier gain required if the overall stage gain to be 75.
- 6.a) What is an electronic oscillator? Write the different types of electronic oscillators.
- b) Draw the circuit diagram of a Hartley Oscillator and derive an expression for the frequency of this circuit.
- c) In a Hartley oscillator the tank coil has two sections of inductance 20 mH and 10 mH. The capacitor has a capacitance of 300 pF. Neglecting the mutual inductance of the coil, find its frequency of oscillation.
- 7.a) Draw the circuit diagram of inverting amplifier and derive an expression for its voltage gain.
- b) Draw a circuit diagram of a Schmitt trigger and describe its principle of operation.

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[Answer any *two* questions from **Group-A** and any *three* questions from **Group-B**;
Separate answer script must be used for Group-A and Group-B.]

Group-A

[Answer any *two* questions]

What is FET? Write down the classification of FET.

What is JFET? Describe its construction and working principle (N-Channel JFET).

A JFET has the following parameters: $I_{DSS} = 32 \text{ mA}$; $V_{GS(off)} = -8 \text{ V}$; $V_{GS} = -4.5 \text{ V}$. Find out the value of drain current.

What is switching circuit? Write down the classification of it.

Explain the switching action of transistor with proper diagram in

- i) OFF region
- ii) ON region

Draw the drain or output Characteristics curves of Enhancement type of MOSFET.

A transistor is used as switch. If $V_{CC} = 10 \text{ V}$; $R_C = 1 \text{ K}\Omega$ and $I_{CBO} = 10 \text{ }\mu\text{A}$, determine the value of V_{CE} when the transistor is

- (i) Cut off
- (ii) Saturation

Draw the symbol of n- channel and p-channel enhancement type of MOSFET.

Explain the operation principle of Monostable Multivibrator with proper diagram.

An E-MOSFET gives $I_{D(on)} = 500 \text{ mA}$ at $V_{GS} = 10 \text{ V}$ and $V_{GS(th)} = 1 \text{ V}$. Determine the drain current for $V_{GS} = 5 \text{ V}$.

Group-B

[Answer any *three* questions]

- 4.a) Define Operational Amplifier. Write down the Ideal Characteristics of an OP AMP.
b) Draw the circuit diagram of inverting and non-inverting OP-AMP and find the gain for both.
c) From the Op-amp circuit, if $v_i = 0.5$ V, calculate (i) the output voltage v_o , and (ii) the current in the $10\text{ K}\Omega$ resistor.

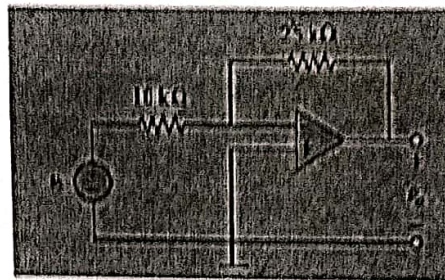


Fig. 4(c)

- 5.a) What is negative feedback?
b) Explain the principle of negative feedback in amplifier.
c) Derive the gain of negative feedback amplifier.
d) When negative voltage feedback is applied to an amplifier of gain 100, the overall gain falls to 50.
(i) Calculate the fraction of the output voltage feedback.
(ii) If this fraction is maintained, calculate the value of the amplifier gain required if the overall stage gain to be 75.
- 6.a) What is an electronic oscillator? Write down the name of different types of transistor oscillators.
b) With proper circuit diagram explain the operation of Hartley Oscillator.
c) In a Hartley oscillator the tank coil has two sections of inductance 80 mH and 20 mH. The capacitor has a capacitance of 500 pF. Neglecting the mutual inductance of the coil, find its frequency of oscillation.
- 7.a) Write short note on comparator circuit and characteristics of it.
b) Draw the circuit diagram of Peak Detector circuit.
c) With proper circuit diagram explain the operation of Schmit Trigger.