

COURSE CODE (CREDITS): 18B11EC313 (4)

MAX. MARKS: 35

COURSE NAME: ELECTRONIC DEVICES AND CIRCUITS

COURSE INSTRUCTORS: Dr. Shruti Jain

MAX. TIME: 2 Hours

Note: (a) All questions are compulsory.

(b) Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Section A (Short Answers : $1 \times 5 = 5$ marks)

1.
 - i. A Field Effect transistor (FET) operates on _____ carriers only.
 - ii. The transconductance of a junction FET can be expressed as _____
 - iii. JFET is a _____ controlled device with _____ input impedance.
 - iv. The location of Q-point on the dc load line of an FET is at _____ point.
 - v. In a class A amplifier the current flows through output circuit for _____.

Section B (Long Answers : $6 \times 5 = 30$ marks)

2. Sita is studying Bipolar Junction Transistor (BJT), Help her in answering following questions:
 - i. Which transistor current is always largest and smallest?
 - ii. Which two currents are relatively close in magnitude
 - iii. Why is collector region of BJT larger than emitter and base regions?
 - iv. Mention the biasing of emitter base and collector base junctions in different modes of transistor operation.
 - v. What is the significance of arrow in the transistor symbol? [5, CO2]
3. Determine the collector current and collector to emitter voltage for [2.5 + 2.5, CO3]
 - i. Fig 1. Assume $V_{BE} = 0.65V$ and $\beta = 60$.
 - ii. Fig 2. Assume $V_{BE} = 0.7V$ and $\beta = 75$.
4. [5, CO6]
 - i. Why are amplifiers connected in cascade? Which transistor configuration is most commonly used for cascade amplifier?
 - ii. Why is direct coupling not suitable for high frequency signal amplification?
 - iii. Why coupling capacitor in RC coupled amplifier is known as blocking capacitor? With the help of diagram show all capacitor with their names.
 - iv. Draw the frequency response of cascade amplifier and mark the different frequencies. How to evaluate bandwidth with the help of frequency response?
 - v. What is the difference between RC coupled and direct coupled amplifier?

[2.5 + 2.5, CO5]

5.
 - i. Determine the value of drain current, gate to source voltage and drain to ground voltage (shown in Fig 3), when $I_{DSS} = 5\text{mA}$, $V_P = -6\text{V}$, $R_D = 1000\Omega$, $R_S = 1500\Omega$, $R_1 = 500\text{k}\Omega$, $R_2 = 1\text{M}\Omega$ and $V_{DD} = 15\text{V}$.
 - ii. In an n-channel JFET biased by potential divider method (shown in Fig 4), it is desired to set the operating point at $I_D = 2.5\text{mA}$ and $V_{DS} = 8\text{V}$. If $V_{DD} = 30\text{V}$, $R_1 = 1\text{M}\Omega$, and $R_2 = 500\text{k}\Omega$, $I_{DSS} = 10\text{mA}$, and $V_{GS(off)} = -5\text{V}$. Find the value of R_S .

[2.5 + 1.5 + 1, CO4]

6.
 - i. Describe the construction and working principle of an N-channel JFET with diagrams. Draw the device characteristics. Write the Shockley equation.
 - ii. Prove that transconductance of FET is a function of gate to source voltage.
 - iii. Define the drain resistance, amplification factor and transconductance of FET. Derive the relationship between three.

[2 + 1.5 + 1.5, CO5]

7.
 - i. For the JFET amplifier circuit as shown in Fig 5, calculate voltage gain with (i) R_S bypassed by a capacitor, (ii) R_S unbypassed. Assume $I_D = 2.3\text{mA}$, $V_{GS} = -1.8\text{V}$.
 - ii. Determine the drain to source voltage in the circuit shown in Fig 6 if $V_{DD} = 18\text{V}$, $R_D = 620\Omega$, $V_{GS(off)} = -8\text{V}$, and $I_{DSS} = 12\text{mA}$.
 - iii. For a certain FET, $V_{GS(off)} = -8\text{V}$, and $I_{DSS} = 10\text{mA}$.
 - a) Is this an n-channel or p-channel.
 - b) Calculate I_D at $V_{GS} = -3\text{V}$.

