Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

## MODULE - I

1. (a) Outline the working of P-N junction diode and draw the V-I characteristics of the diode.
[BL: Understand| CO: 1|Marks: 7]
(b) Find the value of DC resistance and AC resistance of a Germanium junction diode at $250^{\circ} \mathrm{C}$ with reverse saturation current, $I_{o}=25 \mu \mathrm{~A}$ and at an applied voltage of 0.2 V across the diode?
[BL: Apply| CO: 1|Marks: 7]

## MODULE - II

2. (a) Explain in detail about the terms gain, input and output impedances of a N channel MOSFET.
[BL: Understand| CO: 2|Marks: 7]
(b) For the CS amplifier given that $R_{i}=5 \mathrm{k} \Omega, R_{1}=5 \mathrm{M} \Omega, R_{2}=1 \mathrm{M} \Omega, R_{D}=10 \mathrm{k} \Omega$,
$R_{S}=3 \mathrm{k} \Omega, R_{3}=50 \Omega, R_{L}=20 \mathrm{k} \Omega, \mathrm{V}+=24 \mathrm{~V}, \mathrm{~V}-=-24 \mathrm{~V}, K_{0}=0.001 \mathrm{~A} / V_{2}$,
$V_{T O}=1.75 \mathrm{~V}, \Lambda=0.016 \mathrm{~V}-1$. Solve for the gain $\mathrm{Av}=v_{o} / v_{i}$, the input resistance $r_{i n}$, and the output resistance $r_{\text {out }}$. The capacitors can be assumed to be AC short circuit at the operating frequency.
[BL: Apply| CO: 2|Marks: 7]

## MODULE - III

3. (a) Discuss the different coupling schemes which are used in amplifiers. List out the applications of different power amplifiers.
[BL: Understand| CO: 3|Marks: 7]
(b) The two-stage amplifier shown in Figure 1 uses transistors $Q_{1}$ and $Q_{2}$, both having current gain $\beta$ of 80 and dynamic emitter resistance, r'e, of $25 \Omega$ each. Find out the overall voltage gain of the amplifier.
[BL: Apply| CO: 3|Marks: 7]


Figure 1
4. (a) Summarize the following terms of amplifier
i) Frequency response
ii) Decibel gain
iii) Bandwidth
[BL: Understand| CO: 4|Marks: 7]
(b) For a class B amplifier using a supply of $V_{C C}=12 \mathrm{~V}$ and driving a load of $8 \Omega$, determine
i) Maximum load power
ii) DC input power
iii) Collector efficiency.
[BL: Apply| CO: 4|Marks: 7]

## MODULE - IV

5. (a) State the need for feedback. Write the advantages and disadvantages of positive and negative feedback.
[BL: Understand| CO: 5|Marks: 7]
(b) Draw and design a Hartley oscillator with $L_{1}=2 \mathrm{mH}, L_{2}=20 \mu \mathrm{H}$, mutual inductance, $\mathrm{M}=$ $40 \mu \mathrm{H}$ and a variable capacitance. Determine the range of capacitance values, if the frequency range of oscillation is varied between 750 kHz and 3000 kHz . [BL: Apply| CO: 5|Marks: 7]
6. (a) What is the frequency for RC phase shift oscillator? Explain how better frequency stability is obtained in crystal oscillator?
[BL: Understand| CO: 5|Marks: 7]
(b) Choose the value of capacitor C and transistor gain $h_{f e}$ to provide an oscillator frequency of $f_{o}=2 \mathrm{kHz}$ for the circuit in Figure 2. The circuit values are $h_{i e}=2 \mathrm{k} \Omega ; R_{1}=20 \mathrm{k} \Omega ; R_{2}=80$ $\mathrm{k} \Omega ; R_{c}=10 \mathrm{k} \Omega$ and $\mathrm{R}=8 \mathrm{k} \Omega$. Also find the value of feedback resistor $R_{3}$.
[BL: Apply| CO: 5|Marks: 7].


## Figure 2

## MODULE - V

7. (a) Examine the DC and AC performance characteristics of operational amplifier. Differentiate between open loop and closed loop gain of op amp.
[BL: Understand| CO: 6|Marks: 7]
(b) Determine the input impedance and output voltage for the circuit in Figure 3.
[BL: Apply| CO: 6|Marks: 7]


Figure 3
8. (a) Describe the working of a square wave generator using op-amp. List the specifications of practical op amp.
[BL: Understand| CO: 6|Marks: 7]
(b) Calculate the total offset voltage for the circuit of Figure 4 for an op-amp with specified values of input offset voltage, $V_{I O}=4 \mathrm{mV}$ and input offset current $I_{I O}=150 \mathrm{nA}$.
[BL: Apply| CO: 6|Marks: 7]


Figure 4
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