

**BASIC ELECTRONICS ENGINEERING
(ECEN 1001)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

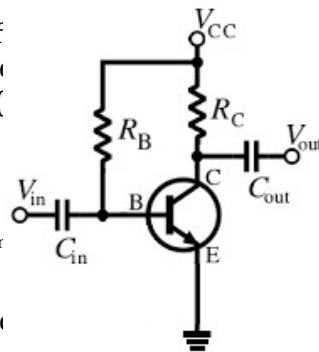
Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

**Group - A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**

- (i) At equilibrium in an unbiased p-n junction
 - (a) net hole current and net electron current are each zero
 - (b) net hole current is equal to the net electron current
 - (c) electron drift current balances hole drift current
 - (d) electron diffusion current balances hole diffusion current
- (ii) Negative feedback in amplifiers
 - (a) results in oscillation
 - (b) reduces gain
 - (c) decreases stability
 - (d) decreases bandwidth.
- (iii) Fixed bias of BJT is not generally used in amplifier because of
 - (a) low operating point stability
 - (b) low power output
 - (c) low input impedance
 - (d) high output impedance.
- (iv) Zener mechanism in a junction device occurs at
 - (a) a low reverse voltage
 - (b) a high reverse voltage
 - (c) a high temperature
 - (d) a low temperature.
- (v) In a centre-tapped full wave rectifier, the peak voltage between centre-tap and one terminal
 - (a) V_m
 - (b) $V_m/2$
 - (c) $V_m/\sqrt{2}$
 - (d) $V_m/\sqrt{2}$.
- (vi) The ripple factor of a full wave rectifier
 - (a) 0.482
 - (b) 1.11
 - (c) 1.21
 - (d) 1.21.
- (vii) For a JFET having $g_m = 5 \text{ mS}$, the transconductance
 - (a) 37.5
 - (b) 77
 - (c) 77
 - (d) 73.
- (viii) If the differential voltage gain is 40 dB and the common mode gain is 0.47, the CMRR is
 - (a) 40dB
 - (b) 10,000
 - (c) 80dB
 - (d) both (b) and (c).



- (ix) Avalanche breakdown is primarily dependent on the phenomenon of
 - (a) collision
 - (b) doping
 - (c) diffusion
 - (d) recombination.
- (x) In a Common Base BJT, for a fixed emitter base junction forward bias, increase in reverse bias across the collector base junction,
 - (a) increases emitter current
 - (b) decreases emitter current
 - (c) keeps emitter current constant
 - (d) makes emitter current zero.

Group - B

- 2. (a) Explain the mechanism of current flow in a biased (i) n-type (ii) p-type semiconductor. Obtain the expression for the electrical conductivity of a p-type semiconductor. Obtain the value of diffusivity-mobility ratio at 300K temperature for a semiconductor material.
- (b) The reverse saturation current at 300K of a p-n junction diode is 10 μA . Find the voltage to be applied across the junction to obtain a forward current of 100mA.

(4 + 3 + 2) + 3 = 12

- 3. (a) Explain the operation of a bridge rectifier with the help of a circuit diagram.
- (b) Evaluate the ripple factor and efficiency of a full wave rectifier.

6 + 6 = 12

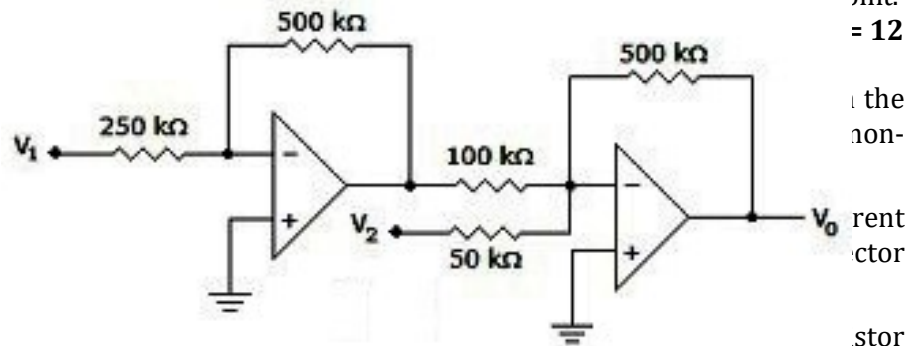
Group - C

- 4. (a) In the fixed bias circuit as shown in Fig 1. $V_{CC} = 10\text{V}$, $R_C = 2 \text{ k}\Omega$, $R_B = 100 \text{ k}\Omega$ Determine the quiescent point and stability factor. Neglect V_{BE} .

Fig.1

- (b) What do you understand by Q point? Why is the stability of Q point essential? Draw the best circuit arrangement to achieve a stable Q point.

5. (a)



(b)

(c)

operation.

6 + 3 + 3 = 12

Group - D

6. (a) With a neat sketch describe the construction of an enhancement-type insulated gate metal-oxide semiconductor FET (MOSFET) using a p-type silicon bar. Point out the structural difference between the enhancement and depletion forms of MOSFET.
- (b) Draw the block diagram of a general purpose CRO and indicate its basic components.

(4 + 3) + 5 = 12

7. (a) A JFET has pinch off voltage (V_p) = - 4.5V, saturation drain current (I_{DSAT}) = 10mA and Drain current (I_D) = 2.5mA. Determine the transconductance.
- (b) Mention the FET parameters and derive the relationship between them.
- (c) Draw the drain and transfer characteristics of n-channel JFET.

4 + 4 + 4 = 12

Group - E

8. (a) Define (i) Slew rate (ii) CMRR.
- (b) Explain the operation of an op-amp comparator circuit.

- (c) In the Fig. 2. If $V_1 = 0.5V$ and $V_2 = 0.1V$, find V_0 .

= 12

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Fig.2

4 + 4 + 4 = 12

9. (a) To an amplifier having 60 dB gain a negative feedback of $\beta = 0.01$ is applied. What would be the change in overall gain of the feedback amplifier if the internal amplifier is subjected to a gain reduction of 11%? Comment on the result.
- (b) Describe the use of an op-amp as an integrator. Derive the input output relation. Draw appropriate input and output waveforms.

(4 + 1) + (5 + 2) = 12