Group – D

6. (a) Explain the difference between Bipolar Junction Transistor (BJT) and Field Effect Transistor (FET).

   (b) With a diagram, describe the construction of an n-channel JFET and explain how the pinch off condition is achieved.

   (c) The pinch off voltage of a p channel JFET is $V_P = 5V$ and $I_{DSS} = -40mA$. The drain to source voltage (V_{DS}) is such that a saturated drain current $I_{DS} = -15mA$ is maintained. Find the gate to source voltage (V_{GS}).

   4 + 5 + 3 = 12

7. (a) Explain the difference between enhancement and depletion type MOSFETs.

   (b) Explain the basic operation of an enhancement type N-channel MOSFETand also draw its circuit. Draw and explain its static characteristics.

   (c) Deduce the relationship $\mu = r_d g_m$.

   3 + 7 + 2 = 12

Group – E

8. (a) What should be the input resistance, output resistance, voltage gain and bandwidth of an ideal operational amplifier?

   (b) Draw the circuit diagram of a difference amplifier using an OP-AMP and find an expression for the output voltage.

   (c) If V_1 and V_2 are two voltages (with respect to ground), how would you construct an OP AMP circuit to get the voltage $V_o = 2V_1 - V_2$.

   4 + 4 + 4 = 12

9. Write Short note on (any three):
   (i) Fermi Dirac Distribution.
   (ii) Light Emitting Diode (LED).
   (iii) FET Parameters.
   (iv) Common Mode Rejection Ratio (CMRR).
   (v) Barkhausen criteria for oscillation.

   4 + 4 + 4 = 12

BASIC ELECTRONICS
(ECEN 1011)

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) Semiconductor material have _____ temperature coefficient of resistance.
   (a) positive   (b) negative
   (c) both positive and negative   (d) none

   (ii) The wavelength of the emitted radiation during recombination depends on the
   (a) forward voltage   (b) forward current
   (c) band gap energy of the material   (d) none of the above.

   (iii) For gate to source voltage $V_{GS}=0V$, the drain current of FET becomes constant when drain to source voltage (V_{DS}) exceeds
   (a) cut-off voltage   (b) V_{DD}
   (c) V_P (d) 0V.

   (iv) If α of BJT is 0.98 then its value of β is
   (a) 0.99   (b) 99
   (c) 50   (d) 49.

   (v) Negative feedback
   (a) increases the input and output impedances
   (b) increases the stability of gain and the bandwidth
   (c) decreases the output impedance and the bandwidth
   (d) does not affect impedances or bandwidth.

   (vi) The effective channel length of a MOSFET in saturation decreases with the increase in
   (a) Source voltage   (b) Gate voltage
   (c) Drain voltage   (d) Body voltage.

(vii) Which one of the following feedback topologies offers high input impedance?
(a) Voltage Series
(b) Voltage Shunt
(c) Current Series
(d) Current Shunt.

(viii) The transconductance of FET is directly proportional to
(a) $\sqrt{V_{ds}}$
(b) I_{dss}
(c) $\sqrt{I_{dss}}$
(d) V_{ds}.

(ix) When you apply a triangular waveform to the input of a differentiator, the output is
(a) A dc level
(b) An inverted triangular waveform
(c) A square waveform
(d) The first harmonic of the triangular waveform.

(x) The slew rate of an ideal OP AMP is
(a) zero
(b) infinite
(c) 1 V/µs
(d) none of these.

Group – B

2. (a) Draw the energy band diagram for intrinsic and extrinsic (both for p type and n type) semiconductor showing fermi level, donor level and acceptor level.

(b) When an extrinsic semiconductor behaves like an intrinsic one? Explain.

(c) What do you mean by drift current and diffusion current flow in a semiconductor?

(d) Distinguish between zener breakdown and avalanche breakdown.
3 + 2 + 4 + 3 = 12

3. (a) Derive the expression of ripple factor and rectification efficiency and also calculate the value of ripple factor and efficiency of a full wave rectifier.

(b) A silicon diode with internal resistance R_f=25 Ω is used for half-wave rectification. The input *a.c.* voltage is V_i=20 sin ωt and the load resistance is 500 Ω. Find ,
(i) d.c output voltage

(ii) a.c input power
(iii) efficiency of rectifier.
6 + 6 = 12

Group – C

4. (a) Explain the operation of NPN transistor in CB configuration with appropriate circuit diagram. What is early effect?

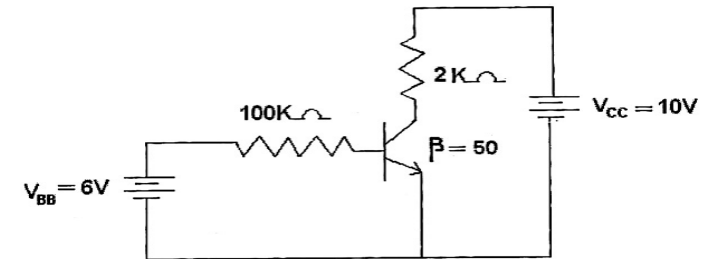(b) Calculate V_{CE} and I_c in the circuit shown in fig. 1. Assume V_{BE} =0.7.

fig. 1

(5 + 2) + 5 = 12

5. (a) Mention the factors responsible for the stability of Q point.

(b) What is the desired position of Q point for a minimum distortion and why?

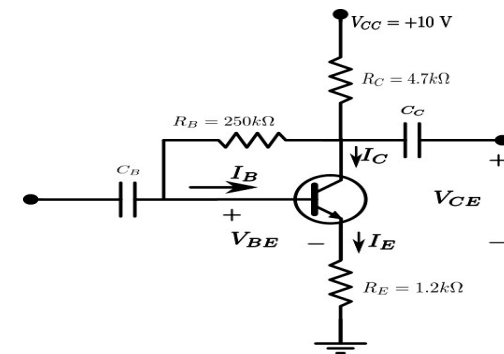(c) In the circuit shown in fig. 2, find the quiescent value of I_E and V_{CE}. Given β =90 and V_{BE} = 0.7.

fig. 2

3 + 3 + 6 = 12