B.Tech/BT/CE/CHE/EE/ME/ 1st Sem/ECEN-1001/2016

2016

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 x 1=10]**

i) Relation between α and β of BJT is

a) $\alpha = \frac{(\beta+1)}{\beta}$ b) $\beta = \frac{\alpha}{(1-\alpha)}$ c) $\beta = \frac{\alpha}{(1+\alpha)}$ d) $\alpha = \frac{\beta}{1-\beta}$

ii) The built-in-potential of a silicon diode is about

a) 2.4V b) 3V c) 3.1V d) 0.7V

iii) The maximum efficiency of a half-wave rectifier is

a) 40.6% b) 56.6% c) 81.2% d) 50%

iv) On increasing temperature the Fermi level moves

a) in n-type semiconductor towards the centre of the band gap

b) in p-type semiconductor towards the centre of the band gap

c) in both n and p type semiconductor towards the centre of the band gap

d) for n-type semiconductor towards conduction band and for p-type semiconductor towards valence band

v) The leakage current across a p-n junction is due to

a) minority carriers b) majority carriers

c) junction capacitance d) none of these

vi) In a transistor, signal is transferred from a _____ resistance to _____ resistance circuit

a) high, low b) low, high c) high, high d) low, low

vii) Operating point represents

a) values of V_{CE} and I_C when ac signal is applied

b) values of I_B and V_{BE}

c) the magnitude of the external signal

d) values of V_{CE} and I_C before the application of ac signal

viii) An inverting op-amp has R_1 = 1KΩ and R_f= 100KΩ; the input impedance is

a) 1KΩ b) 100KΩ c) 101KΩ d) infinite

ix) In an oscillator

a) negative feedback is used b) positive feedback is used

c) ac input signal is applied d) amplification occurs

x) The effective channel length of a MOSFET in saturation, decreases with increase in

a) gate voltage b) drain voltage c) source voltage d) body voltage

GROUP - B

2 a) For an unbiased p-n junction, sketch the variation of the space charge, electric field, electrostatic potential and electron energy as a function of distance across the junction.

b) 'Zener breakdown voltage has a negative temperature co-efficient whereas avalanche break-down voltage has a positive temperature co-efficient'. Explain

c) "The dynamic resistance of an ideal Zener diode is zero but the dc resistance is not so".Explain the reason.

d) A silicon diode has a reverse saturation current of 0.1nA at room temperature. Find its current when it is biased in the forward direction by 0.55V.

4+2+3+3=12

3 a) Giving relevant defining equations, explain the phenomenon of drift and diffusion associated with carrier movement in semiconductors.

b) State mass-action law. Explain its meaning.

c) Calculate the thermal-equilibrium electron and hole concentrations in a germanium sample for a given doping density. Consider a germanium sample at T = 300K in which $N_d = 5 \times 10^{-13}$ cm^{-3} and N_a=0. Assume that $n_i = 2.4 \times 10^{13}$ cm^{-3}.

5+3+4=12

GROUP - C

4 a) Name the three possible transistor connections. Explain the operation of transistor as an amplifier.

b) Define β. Show that $\beta = \frac{\alpha}{(1-\alpha)}$.

c) A transistor has I_B= 105μA and I_c = 2.05mA. Find the following:
i) β of transistor ii) α of transistor iii) emitter current I_E.

(1+4)+(1+3)+3=12

5 a) What do you mean by the quiescent point of a transistor amplifier?

b) What is load line of a BJT? Explain its significance.

c) A CE mode amplifier is biased by a potential divider circuit. Here R1 = 60kΩ; R2 = 10kΩ, β =60. Find the value of the stability factor when R_E= 1kΩ and 3kΩ.

2+4+6=12

GROUP - D

6 a) When is channel of a JFET said to be pinched off? Define the pinch-off voltage. Give the relationship between the pinch-off voltage, the saturation voltage and the gate source voltage. What is pinch-off current?

b) BJT is characterized by current gain but FET is characterized by trans-conductance gain-- Explain.

(2+2+3+1)+4=12

7 a) Why is the field-effect transistor called a unipolar transistor? Draw schematically the structure of an n-channel MOSFET and explain the terms source, drain, gate and substrate. What is the significance of the terms field-effect?

b) What is the major physical difference between an enhancement-type and a depletion-type MOSFET?

c) Draw the typical volt-ampere drain characteristics curve of a p-channel enhancement mode MOSFET?

(1+4+2)+3+2=12

GROUP - E

8. a) Explain with the help of a block diagram the working principle of a feedback amplifier. Find out an expression for the voltage gain with feedback.

   b) Write down the condition of oscillation.

   c) A feedback amplifier is designed with closed loop gain of 100. The maximum allowable variation in closed loop gain is 1% where as that in open-loop gain is 10%. Determine the open loop voltage gain and the feedback factor for the amplifier.

(3+2)+3+4=12

9 a) Define the following parameters in respect of OP AMP:
   i) CMRR ii) Slew Rate iii) Offset voltage

   b) In an OP AMP, when the voltage applied to the inverting input terminal is $v_1 = 50\mu V$ and that applied to the inverting input terminal is $v_2 = -50\mu V$, what is the output voltage, if the voltage gain for the difference signal is A_d? If the Common Mode Rejection Ratio is 1000, calculate the percentage difference of the output voltage obtained with $v_1 = 500\mu V$ and $v_2 = 400\mu V$.

(2+2+2)+(4+2)=12
