BRAINWARE UNIVERSITY

Course – BSc(HN)

Basic Electronics II: Analog Electronics (EC201/BHNG201)

(Semester – 2)

Time allotted: 3 Hours   **Full Marks : 70**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group –A

(Multiple Choice Type Questions)   10 x 1 = 10

1. *Choose the correct alternative from the following*

(i)   The common-mode gain is

      a. very high   b. very low

      c. always unity   d. unpredictable

(ii)   A voltage follower

      a. has a voltage gain of 1   b. is non-inverting

      c. has zero feedback resistor   d. has all of these

(iii)   Operating point represents

      a. values of i_c and v_{ce} when signal is applied   b. the magnitude of signal voltage

      c. zero signal values of I_C and V_{CE} d.   none of these

(iv)   The input offset current equals the

      a. difference between two base currents   b. average of two base currents

      c. collector current divided by current gain   d. none of these

(v) For proper operation of the transistor, its collector should have

    a. proper forward bias   b. proper reverse bias

    c. very small size   d. none of the these

(vi) An ideal value of stability factor is

    a. 100   b. 200

    c. more then 200   d. 1

(vii) Hartley oscillator is commonly used in

    a. radio receivers   b. radio transmitters

    c. TV receivers   d. none of these

(viii) The piezoelectric effect in a crystal is

    a. a voltage developed because of mechanical stress   b. a change in resistance because of temperature

    c. a change in frequency because of temperature   d. none of these

(ix) When voltage feedback (negative) is applied to an amplifier, its input impedance

    a. is decreased   b. is increased

    c. remains the same   d. any one of these

(x) A JFET has three terminals, namely

    a. cathode, anode, grid   b. source, gate, drain

    c. emitter, base, collector   d. none of these

Group – B

(Short Answer Type Questions)   3 x 5 = 15

Answer any *three* from the following

2. What is slew rate? Explain virtual ground concept of an Op-Amp.   [2+3]
3. What do you mean by CMRR of an Op-Amp? Calculate the common mode gain of an operational amplifier from the following parameters: the differential voltage gain $A_d=10^4$ and CMRR=2000.   [2+3]
4. Compare a FET with a BJT. Illustrate why BJT is called the current controlled device.   [3+2]
5. Describe the use of an OPAMP as a comparator.   [5]
6. Establish the relation $\mu = r_d g_m$, where the notations have their usual meanings.   [5]

Group – C

(Long Answer Type Questions) 3 x 15 = 45

Answer any *three* from the following
7. (a) Draw the circuit diagram for the collector-to-base bias of an n-p-n transistor in the CE configuration. Obtain expressions for its stability factors. [7]

(b) In the collector to base bias circuit of a transistor, V_{CC}=12 V, R_B=100 KΩ and R_L=2 KΩ. If β=99, I_{CO}=20 nA and V_{BE}=0.7 V, determine I_B, I_C and V_{CE}. Also find the stability factor w. r. t. I_{CO}. Here, notations used have their usual meanings. [8]

8. (a) Develop the theory of action of an OPAMP as a differentiator. [5]

(b) Draw the circuit diagram of a difference amplifier using an OPAMP and find an expression for the output voltage. [2+5]
Write short notes on input offset voltage. [3]

9. (a) Explain with a circuit diagram the action of a Wien bridge oscillator. Find an expression for the frequency of oscillation. [2+3]

(b) Prove that the gain of the amplifier used in a Wien-bridge oscillator must be greater than 3 for sustained oscillations. [5]

(c) A Wien-bridge oscillator has a frequency of 1000 Hz and a capacitance of 100 pF. Find the resistance. If the amplifier gain is 10, obtain the ratio of the resistances in the in the other arms. [5]

10. (a) Write a short note on Schmitt Trigger and also find the width of hysteresis loop. [5+3]

(b) An inverting amplifier has a gain of 80 and it is used to amplify a sinusoidal input signal of variable frequency and maximum amplitude of 12.5 mV. Find the maximum operating frequency of the amplifier given that the slew rate is 2.5 V/μs . [7]

11. (a) Explain with a circuit diagram the operation of a push-pull amplifier. Obtain an expression for the maximum efficiency of the amplifier. [9]

(b) Describe with circuit diagram the action of i) emitter follower ii) Darlington pair. [3+3]