



## BRAINWARE UNIVERSITY

Course –BSc(CS)

Basic Electronics II: Analog Electronics (BCSG201)

(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 Question)

1 x 10 = 10

**Answer any ten of the following**

- 1.i) In order to work as a linear amplifier, a transistor must operate in
- a) Active region      b) Saturation region      c) Breakdown region      d) None of these
- ii) The load line moves parallel to itself in CE output characteristics of a transistor when
- a)  $R_L$  changes      b)  $V_{CC}$  changes
- c) Both  $V_{CC}$  and  $R_L$  change      d) None of these
- iii) If  $A_I$ ,  $A_V$  and  $A_P$  are current, voltage and power gains of a transistor amplifier, then
- a)  $A_V = \frac{A_P}{A_I}$       b)  $A_V = A_P A_I$       c)  $A_V = A_P + A_I$       d)  $A_V = A_P - A_I$
- iv) The gain of Wien Bridge Oscillator is greater than
- a) One      b) Two      c) Three      d) none of these
- v) Wien Bridge Oscillator is used in the range
- a) Audio frequency      b) Radio frequency
- c) Very high frequency (VHF)      d) Microwave frequency

vi) FET is advantageous over BJT since

- a) It is thermally more stable                      b) It uses one p-n junction  
c) It is a voltage controlled device              d) none of these

vii) The transconductance of a FET is

- a) directly proportional to  $\sqrt{V_{DS}}$                       b) directly proportional to  $I_{DS}$   
c) directly proportional to  $\sqrt{I_{DS}}$                       d) none of these

viii) Which of the following devices is expected to have the largest input impedance

- a) MOSFET              b) BJT              c) JFET              d) none of these

ix) The number of pins of the IC741 op-amp is

- a) 8              b) 10              c) 12              d) 14

x) For OPAMP, the maximum rate of change of output voltage per unit time is

- a) slew rate    b) CMRR    c) offset voltage    d) supply voltage rejection ratio

xi) The two input terminals of an operational amplifier are called as

- a) differential and non-differential                      b) inverting and non-inverting  
c) positive and negative                                      d) high and low

xii) When the two input terminals of a practical difference amplifier are grounded then

- a) the dc output voltage is zero                      b) the ac output voltage is zero  
c) there exists output offset voltage                      d) none of these

### Group – B

(Short Answer Type Question)

3 x 5 = 15

**Answer any three of the following**

2. Draw the circuit diagram for fixed bias n-p-n transistor in CE mode. Obtain expressions for its stability factors. Mention demerits of this circuit. What are the functions of the coupling capacitors?

[5]

3. Write short notes on i) Emitter follower ii) Darlington pair [2+3]
4. Sketch the circuit of summer using OPAMP to get  $V_0 = -V_1 - 2V_2 - 3V_3$  [5]
5. Describe the use of an OPAMP as comparator. [5]
6. The input base currents of a differential amplifier are  $I_{B1}=100 \text{ nA}$  and  $I_{B2}=80 \text{ nA}$ .
- a) Determine the input offset current. b) When  $A = 10^5$ , calculate the output offset voltage.  
Assume  $R_S=1\text{K}\Omega$  [5]

### Group – C

(Long Answer Type Question)

3 x 15 = 45

**Answer any three of the following**

7. a) Illustrate the representation of a transistor as a two-port device in terms of h parameters. [5]
- b) Drawing the equivalent circuit, obtain expressions for current gain, input impedance, voltage gain and output impedance of a small signal single-stage low frequency transistor amplifier in CE mode. [10]
- 8.a) Explain with circuit diagram the action of a Wien bridge oscillator. Find an expression for the frequency of oscillation. [10]
- b) A Wien bridge oscillator has a frequency of 1KHz and capacitance 100pF. Find 'R'. If the amplifier gain is 10, find the ratio of resistances in other arms. [5]
9. a) Draw the circuit diagram of a common source n-channel JFET amplifier. Develop the theoretical formulation for small signal voltage equivalent circuit. Hence, calculate the small signal voltage gain of the amplifier. [2+4+4]
- b) The transconductance and the ac drain resistance of a FET are 0.2 mA/V and 150 K $\Omega$  respectively. This device is used in the common source configuration with a load resistance of 150 K $\Omega$ . Determine the small signal voltage gain. [5]

10. a) State the characteristics of an ideal OPAMP. [5]
- b) The charging current of a 150pF capacitor is 100  $\mu$ A. What is the slew rate of the operational amplifier? [3]
- c) Write a short note on Schmitt Trigger and also find the width of hysteresis loop. [5+2]
11. a) Develop the theory of action of an OPAMP as an integrator. Draw the circuit diagram of practical integrator. [5+2]
- b) An ideal OPAMP has the output connected with the inverting input through resistance of 1 K $\Omega$ . An ac voltage 5V (R. M. S. value) is applied through a series-resistance of 5 K $\Omega$  between non-inverting Input and ground. Draw the circuit diagram and find the output voltage. [5]
- c) Calculate the common mode gain of an operational amplifier for the following parameters:  
The differential voltage gain  $A_d=10^4$  and CMRR=2000. [3]