



BRAINWARE UNIVERSITY

Course – BSc(CS)

Basic Electronics II: Analog Electronics (EC201/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 Questions)

10 x 1 = 10

1. Choose the correct alternative from the following

(i) The number of pins of the IC741 OP-AMP is

- | | |
|-------|-------|
| a. 8 | b. 10 |
| c. 12 | d. 16 |

(ii) The saturation point on the d.c. load line is

- | | |
|---|---|
| a. $V_{CE} = 0, I_{C,sat} = \frac{V_{CC}}{R_C}$ | b. $V_{BE} = 0, I_{C,sat} = \frac{V_{CC}}{R_C}$ |
| c. $V_{CE} = 0, I_{C,sat} = \frac{V_{BB}}{R_C}$ | d. $V_{BE} = 0, I_{C,sat} = \frac{V_{BB}}{R_C}$ |

(iii) The maximum rate of change of output voltage per unit time is

- | | |
|-------------------|---------|
| a. Slew rate | b. CMRR |
| c. offset voltage | d. SVRR |

(iv) FET is advantageous over BJT since it is

- | | |
|--------------------------------------|----------------------------|
| a. thermally more stable | b. it use one p-n junction |
| c. it is a voltage controlled device | d. none of these |

- (v) An ideal OP AMP has
- infinite input impedance
 - zero output impedance
 - infinite voltage gain
 - all of the these
- (vi) Transconductance of a FET is proportional to
- $\sqrt{V_{DS}}$
 - I_{DS}
 - $\sqrt{I_{DS}}$
 - none of these
- (vii) The slew rate of an ideal OP AMP is
- zero
 - infinite
 - 1 V/ μ s
 - 10 V/ μ s
- (viii) An amplifier has gain of -1000 and feed back ratio $\beta = -0.1$. If it had change of gain by 20% due to change of temperature, what will be the change in the gain of the feedback amplifier
- 1%
 - 2%
 - 0.5%
 - 0.2%
- (ix) If FET operates in cut-off, the depletion layers are
- touching each other
 - close together
 - far apart
 - None of these
- (x) The feedback element in the integrator is a
- capacitor
 - inductor
 - diode
 - resistance

Group – B

(Short Answer Type Questions)

3 x 5 = 15

Answer any *three* from the following

- With necessary explanation, represent a transistor as a two-port device in terms of h parameters. [5]
- Sketch the structure of a p channel depletion type MOSFET. Explain how the depletion region is produced in the channel. Can a depletion MOSFET work in the enhancement mode? If so how? [5]
- Describe the use of an OPAMP as inverting amplifier. [5]

5. Draw the circuit diagram for self-bias arrangement for an n-p-n transistor in the CE configuration.
Derive the expression for its stability factor with respect to I_{CO} . [5]
6. Draw the circuit diagram of a difference amplifier using an OPAMP and find an expression for the output voltage. [5]

Group – C

(Long Answer Type Questions)

3 x 15 = 45

Answer any *three* from the following

7. (a) Describe the use of an OPAMP as summing amplifier. [5]
(b) Sketch the circuit diagram of OPAMP to get $V_0 = -V_1 + 2V_2 - 3V_3$ [5]
(c) Calculate the output voltage for the summing amplifier circuit using OPAMP. Given $V_1=0.2V, V_2=2V, V_3=1V$ and $R_1=5K\Omega, R_2=20K\Omega, R_3=50K\Omega$ and $R_f=30K\Omega$, where notations carry the usual meanings. [5]
8. (a) Draw the circuit diagram for base bias considering an n-p-n transistor in CE configuration. Derive expressions for its stability factors. Mention demerits of this circuit. What are the functions of the coupling capacitors? [2+6+2]
(b) In the base bias circuit of a transistor, $V_{CC}=15V, R_B=300K\Omega$ and $R_L=2K\Omega$. If $\beta=100, I_{CO}=20nA$ and $V_{BE}=0.7V$, find the Q point analytically. [5]
9. (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 $10K\Omega$. Voltage of value $3V$ is applied through a series-resistance of $5K\Omega$ between non-inverting input and ground. The inverting input is kept open. Draw the circuit diagram and find the output voltage. [5]
(c) Calculate the common mode gain of an operational amplifier having the following parameters: The differential voltage gain $A_d=10^4$ and $CMRR=2000$. [3]
10. (a) Describe with a circuit diagram the action of a Wien bridge oscillator. Find an expression for the frequency of oscillation. [3+7]
(b) A Wien-bridge oscillator has a frequency of $1000Hz$ and a capacitance of $100pF$. Find the resistance. If the amplifier gain is 10 , obtain the ratio of the resistances in the other arms. [5]
11. (a) Describe with circuit diagram the action of i) emitter follower and ii) Darlington pair [3+3]
(b) Explain with a circuit diagram the operation of a push-pull amplifier. Obtain an expression for the maximum efficiency of the circuit. [4+5]