

2011

ANALOG ELECTRONIC CIRCUITS

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$10 \times 1 = 10$

i) A stable multivibrator may be used as

a) frequency to voltage converter

b) voltage to frequency converter

c) square wave generator

d) comparator.

ii) Negative feedback in amplifier

- a) increases bandwidth and increases gain
- b) increases bandwidth and decreases gain
- c) decreases bandwidth and decreases gain
- d) decreases bandwidth and increases gain.

iii) Which of the following is linear ?

- a) Current to voltage converter
- b) Logarithmic amplifier
- c) Comparator
- d) Square wave generator.

iv) For a given op-amp, CMRR = 10^5 and differential gain = 10^5 . What is the common mode gain of the op-amp ?

- a) 10^{10}
- b) 10^5
- c) 2×10^5
- d) 1.

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- viii) The output of an integrator having square wave as input is
- a) triangular
 - b) ramp
 - c) spike
 - d) parabolic.
- ix) The all-pass filter has
- a) no pass band
 - b) one stop band
 - c) same gain at all frequency
 - d) a first roll-off above cut-off.
- x) An instrumentation amplifier
- a) is a differential amplifier
 - b) has a gain less than 1
 - c) has a very high output impedance
 - d) has low CMRR.
- xi) A precision diode may be used for
- a) half-wave and full-wave rectification
 - b) peak value detector
 - c) clipper and clamper
 - d) all of these.

xii) An all-pass filter is used when

- a) high roll-off rate is needed
- b) phase shift is important
- c) a maximally flat pass band is needed
- d) a ripple stop band is important.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Draw the circuit of a series voltage regulator and explain its operation.

3. Define the following parameters in connection to op-amp :

$$2 \times 2 \frac{1}{2}$$

a) CMRR

b) Slew rate.

4. Explain the operation of a current mirror circuit.

5. Define "thermal runaway" and "stability factor" of a transistor.

$$2 \frac{1}{2} + 2 \frac{1}{2}$$

6. With a neat diagram explain the concepts of "load line" and "Q point" of a transistor.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Write down the h -parameter equations of a transistor amplifier and define h -parameters. $2 + 4$
- b) Model a h -parameter equivalent circuit by following above equations. Hence derive the expressions of the following :
 - i) Voltage gain
 - ii) Input impedance. $2 + 4 + 3$
8. a) Draw the circuit of self biasing arrangement of a pnp transistor. Explain physically how this arrangement provides a good stability against temperature variation. Also derive the expression for stability factor. $2 + 4 + 6$
- b) Draw the circuits of fixed bias and collector to base bias arrangements of transistor. $1 \frac{1}{2} + 1 \frac{1}{2}$
9. Explain the operation of the following circuits using op-amp : $7 \frac{1}{2} + 7 \frac{1}{2}$
 - a) Logarithmic amplifier
 - b) Schmitt trigger.
10. a) Draw the circuit diagram of an emitter follower and explain the nature of feedback in this circuit. What type of feedback topology is used here ? Derive an expression for the voltage gain of the circuit. $3 + 1 + 3$
- b) Draw the circuit diagram of a push-pull class B power amplifier and derive the expression for its power efficiency. $2 + 6$

11. a) Draw the circuit of a Wien-bridge oscillator and derive the expression for its frequency of oscillation. 8
- b) Explain the operation of a monostable multivibrator using 555 timer. 7
12. Write short notes on any *three* of the following : 3 × 5
- a) Voltage controlled oscillator
- b) Level shifter
- c) Precision rectifier
- d) Switched Mode Power Supply (SMPS)
- e) Voltage to current converter.