MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code :EC(EI)-302

ANALOG ELECTRONIC CIRCUIT

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 alternative for *any ten* of the following: 1×10=10

(i) The feedback factor β at the frequency of oscillation of a Wien-bridge oscillator is
(a) 3
(b) 1/3
(c) 1/29
(d) 3/29

(ii) The use of crystal in a tunable oscillator
(a) improves frequency stability
(b) increases the gain of the oscillator
(c) helps to obtain optimum output impedance
(d) facilitates generation of wide range of frequencies

(iii) Which multivibrator is a square wave oscillator?
(a) monostable
(b) astable
(c) bistable
(d) None of the above

(iv) The function of a bleeder resistor in a power supply is
(a) the same as that of load resistor
(b) to ensure a minimum current drain in the circuit
(c) to increase the output dc voltage
(d) to increase the output current

(xii) If a square wave is fed to a differentiating circuit, the output will be

(a) sine wave (b) sharp narrow pulses

(c) rectangular wave (d) triangular wave

Group – B

(Short Answer Type Questions)

Answer *any three* of the following. 5×3=15

2. Draw the circuit diagram of a two-stage RC coupled CE transistor amplifier and show how the magnitude and phase angle of its voltage gain vary with frequency.

3. Explain the operation of current mirror circuit.

4. Explain the term transistor biasing. What are the factors determining the choice of Q-point? 2+3=5

5. Explain the operation of a series voltage regulator with proper circuit diagram.

6. For the ac equivalent circuit of a Hartley oscillator, determine the frequency of oscillation.

Group – C

(Long Answer Type Questions)

Answer *any three* of the following. 15×3=45

7. (a) With necessary h-parameter equivalent circuit of low frequency CE mode transistor amplifier, calculate the following in terms of h-parameters:

(i) input resistance

(ii) power gain

(b) An RC-coupled amplifier employs two identical transistors, each having $h_{fe} = 100$, $h_{ie} = 2k\Omega$ and $C_{ob} = 2pF$. The coupling capacitor has a capacitance $C = 0.4\mu F$. The load resistance for each transistor is $R_L = 8k\Omega$. Taking the wiring capacitance as $C_w = 10pF$, calculate the lower and upper half-power frequencies.

(c) Explain the operation of voltage-to-current converter with

(i) floating load, and

(ii) grounded load (4+3)+4+(2+2)=15

8. (a) Show that, at the lower half power frequency, the phase angle of an RC-coupled transistor amplifier is 225°.

(b) A silicon transistor with $\beta = 50$, $V_{BE} = 0.6V$, $V_{CC} = 12V$ and $R_C = 5.6K\Omega$ is used for self-biasing circuit. It is desirable to establish Q-point at $V_{CE} = 12V$, $I_C = 1.5mA$ and a stability factor $S \leq 3$. Find $R_E = R_1$ and R_2.
(The symbols have their usual meanings).

(c) Explain how temperature compensation can be achieved for antilog amplifier using Op-Amp.

6+4+5=15

9. (a) Using a suitable diagram, prove that the gain of an RC phase shift oscillator is 29.

(b) What is the difference between Hartley and Colpitt's oscillator.

(c) Explain the operation of the following two circuits:

(i) differential amplifier

(ii) precision rectifier

6+3+(3+3)=15

10. (a) What do you mean by multivibrator?

(b) With detailed circuit diagram, explain the operation of a monostable multivibrator circuit using 555 timer IC.

(c) Derive the expression of frequency of oscillation for monostable multivibrator circuit using 555 timer IC.

(d) Determine the positive pulse width, negative pulse width and free-running frequency for an astable multivibrator using 555 timer, $R_A = 4.7K$, $R_B = 1K$, $C = 1\mu F$, $C_1 = 0.01\mu F$. What is the duty cycle of output waveform?

2+(3+3)+3+4=15

11. Write short notes on *any three* of the following:

5×3=15

(i) Phase locked loop

(ii) Antilog amplifier

(iii) SMPS

(iv) Crystal oscillator

(v) Schmitt trigger