



Name :

Roll No. :

Invigilator's Signature :

**CS/B.TECH(EIE-N)/SEM-3/EC(EI)-302/2011-12
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) An ideal op-amp has CMRR and slew rate respectively

- a) infinity and infinity b) zero and infinity
c) zero and zero d) infinity and zero.

ii) An astable multivibrator generates

- a) triangular waveform b) sinusoidal waveform
c) square waveform d) none of these.



iii) An op-amp is an open loop configuration which can be used as

- a) Comparator b) Log amplifier
- c) Integrator d) Differentiator.

iv) Schmitt trigger is a comparator using

- a) negative feedback
- b) positive feedback
- c) both positive and negative feedbacks
- d) none of these.

v) According to Barkhausen criteria in order to sustain the oscillations

- a) loop gain of the circuit must be negligible
- b) loop gain of the circuit must be equal to unity
- c) the phase shift around the circuit must be 180 degree
- d) none of these.



vi) An op-amp has a voltage gain of 500000. If the output voltage is 1V, the input voltage is

- a) 2 mV b) 5 mV
- c) 10 mV d) 1V.

vii) When the Q point is the centre of the *ac* load line, the maximum peak-to-peak output voltage equals

- a) V_{CEQ} b) $2 V_{CEQ}$
- c) $V_{CEQ} / 2$ d) none of these.

viii) Which one of the following feedback topologies offers high input impedance ?

- a) Voltage series b) Voltage shunt
- c) Current series d) Current shunt.

ix) In phase shift oscillator the feedback circuit (lag circuit) produces phase shift of

- a) 180° b) $- 270^\circ$
- c) 360° d) $- 180^\circ$.



- x) For a wide range of oscillations in the audio range, the preferred oscillator is
- a) Hartley
 - b) Phase shift
 - c) Wien-bridge
 - d) Hartley and Colpitt.
- xi) Astable multivibrator may be used as
- a) frequency to voltage converter
 - b) voltage to frequency converter
 - c) squaring circuit
 - d) comparator circuit.
- xii) Transformer couple class A power amplifier provides very high frequency because the
- a) collector voltage is stepped up
 - b) *dc* resistance in the collector circuit is low
 - c) large signal amplifier
 - d) none of these.
- xiii) To avoid false triggering of the NE 555 timer the RESET pin (Pin 4) is generally connected to
- a) Pin 8
 - b) Pin 1
 - c) Pin 3
 - d) No connection (NC).



xiv) Miller capacitance is generated in

- a) CB configuration b) CC configuration
- c) CE configuration d) All configurations.

xv) The output gain of an emitter follower circuit is

- a) greater than 1 b) equal to 1
- c) less than 1 d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. Find out the ripple factor of a full-wave rectifier.
3. Find out the condition of an astable multivibrator so that its duty cycle would be less than 50% and draw the circuit diagram.
4. Explain how the bandwidth of an amplifier will be increased using negative feedback.
5. Draw the high frequency model of a transistor and define all parameters.
6. What is an instrumentation amplifier ? How a basic differential amplifier is modified to a grounded load instrumentation amplifier ? 1 + 4
7. Explain the monostable operation of NE 555 with proper circuit diagram and waveform.



GROUP – C

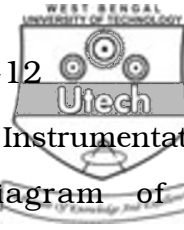
(Long Answer Type Questions)

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

8. a) Why hybrid parameters are so called ?
- b) Draw the equivalent circuit of a transistor using h parameters. Determine input impedance, current gain and voltage gain and output admittance in terms of h parameters.
- c) Obtain h -parameters of CE mode in terms of those of CB mode. $2 + 8 + 5$
9. a) Explain how it is possible to achieve better Q -point stabilization by using self bias circuit. Assume relevant assumptions.
- b) Consider a self bias circuit with an $n p n$ silicon transistor CE configuration. The circuit is designed in such a way that the $I_C = 1.5 \text{ mA}$, $V_{CE} = 10 \text{ V}$ and the stability factor is less than equal to 6. If $V_{CC} = 20 \text{ V}$, $V_{BE} = 0.7 \text{ V}$, $B = 100$, $R_C = 5 \text{ K}$, calculate the values of R_E , R_1 , R_2 .
- c) How the operating point of a transistor can shift ? How will you define the stability factors for a transistor ? $5 + 5 + 5$



10. a) Draw the circuit diagram of a Heartley oscillator and explain its operation.
- b) Draw the *ac* equivalent circuit of Heartley oscillator and determine the frequency of oscillation.
- c) The frequency of a Heartley oscillator is to vary from 60 kHz to 120 kHz. The tuning capacitor can be changed from 100 pF to 400 pF. The transistor employed in the circuit has $h_{fe} = 90$ and $\Delta_{he} = 0.2$. Find the values of the inductances, neglecting the mutual inductance between them. 5 + 5 + 5
11. a) Draw the circuit diagram of a controlled transistor series regulator. Explain the circuit and the functionality of pass transistor. Write down the expression of output voltage. 2 + 1 + 1
- b) Design a complete + 15 V power supply starting from transformer and using 78XX series IC. 5
- c) Why does Q point of a transistor shift? What are the different techniques for bias compensation? Design suitable compensation circuit for variation of V_{BE} and I_{CO} . 1 + 1 + 4



12. a) What are the criteria of a good Instrumentation Amplifier ? Draw the circuit diagram of an Instrumentation Amplifier using transducer bridge and explain its operation.
- b) Explain the operation of an inverting Schmitt trigger circuit.
- c) Explain with circuit diagram the operation of voltage to current converter with grounded load. $7 + 4 + 4$
13. Write short notes on any *three* of the following : 3×5
- a) Comparator
- b) Full-wave precision rectifier
- c) PLL
- d) VCO
- e) Phase shift oscillator.

