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°

c) 360° d) – 180°.

x) For a wide range of oscillations in the audio range, the preferred oscillator is

a) Heartley
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 × 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 *npn* silicon transistor CE configuration. The circuit is designed in such a way that the $I_C = 1{\cdot}5$ mA, $V_{CE} = 10$ V and the stability factor is less than equal to 6. If $V_{CC} = 20$V, $V_{BE} = 0{\cdot}7$ V, B = 100, $R_C = 5$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 it's 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 $\Delta_{he} = 0 \cdot 2$. 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 compension 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 follwing : 3 × 5

a) Comparator

b) Full-wave precision rectifier

c) PLL

d) VCO

e) Phase shift oscillator.