Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(EE-OLD)/SEM-4/EC(EE)-401/2012

2012

ANALOG ELECTRONICS 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) The gain of the emitter follower is approximately equal to

   a) α b) β

   c) $1+\beta$ d) $\frac{1}{1-\alpha}$.

   ii) To improve the efficiency of the amplifier we have to

   a) reduce the power dissipation rating

   b) reduce supply voltage

   c) reduce the load power

   d) reduce unwanted power loss.

iii) An instrumentation amplifier

a) is a differential amplifier

b) has a gain less than 1

c) has very high output impedance

d) has low CMRR.

iv) In an amplifier, a coupling capacitor is used to

a) match the impedance

b) control frequency

c) limit the bandwidth

d) prevent *dc* mixing with the output.

v) To avoid false triggering of the NE 555 timer, the RESET pin (Pin 4) is generally connected to

a) Pin 8 b) Pin 3

c) Pin 1 d) No Connection (NC).

vi) The output pulse width for a monostable multivibrator using IC 555 where external resistance & capacitance are 20 kΩ & 0·1 μF is

a) 2·1 s b) 2 ms

c) 2·5 ms d) 2·2 μs.

vii) A differential amplifier has R_1 = 10 kΩ (equal both collector), h_{ie} = 1 kΩ, R_e = 50 kΩ, h_{fe} = 100. The common mode gain is

a) 500 b) 2

c) 0·2 d) 0·1.

viii) A MOSFET differs from JFET mainly because of

a) power rate

b) MOSFET has two gates

c) JFET has a *pn*-junction

d) MOSFETs do not have a physical channel.

ix) Instrumentation amplifiers are used for

a) high noise environment

b) medical equipment

c) test instrument

d) none of these.

x) Differential amplifier can be used to amplify

a) only AC signal b) only DC signal

c) both AC & DC signals d) none of these.

xi) The input resistance of a common base amplifier is

a) very low b) very high

c) same as CE d) same as CC.

xii) A certain common-emitter amplifier has voltage gain 100. If the emitter bypass capacitor is removed

a) circuit will become unstable

b) *q*-point will shift

c) voltage gain will increase

d) voltage gain will decrease.

xiii) Negative feedback in amplifier

a) increases both gain and bandwidth

b) increases gain and decreases bandwidth

c) increases bandwidth and decreases gain

d) decreases both gain and bandwidth.

xiv) A push pull amplifier balances out

a) odd harmonies

b) even harmonies

c) both odd and even harmonies

d) neither odd nor even harmonies.

xv) An ideal Op-Amp has

a) infinite common mode gain and zero differential gain

b) infinite common mode gain as well as differential gain

c) infinite differential gain and zero common mode gain

d) zero common mode gain as well as differential gain.

GROUP – B

(Short Answer Type Questions)

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

2. Derive the relationship between drain to source current (I_{ds}) and drain to source voltage $(V_{ds})$for MOSFET. Find the MOS transconductance (g_m) and output conductance (g_{ds}).

3. Define the stability factor & thermal run away. Draw & explain the operation of transistor connected in CB mode.

4. Why is emitter resistance R_E in an emitter-coupled differential amplifier replaced by a constant current source ? Explain why the network replacing R_E acts as an constant current I_0.

5. a) Draw the output waveforms if input of a differentiator is
   i) Triangular wave
   ii) Square wave.
   b) Obtain the expression for output voltage of an integrator using Op-Amp.

6. Write a note with related mathematical derivation of Op-Amp as an inverting & non-inverting amplifier. What is buffer ?

GROUP – C

(Long Answer Type Questions)

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

7. a) Draw and explain the functional diagram of 555 Timer. 6

   b) Draw the circuit and explain the operation of an Monostable multivibrator using a 555 Timer. 6

   c) In 555 Timer monostable multivibrator using R = 100 kΩ and time delay = 100 μs, calculate the value of c. 3

8. What is self-bias ? Draw the circuit diagram showing self-bias of a *n-p-n* transistor in the CE configuration. Explain physically & mathematically how the self-biasing resistor improves the stability. Explain the function of bypass and coupling capacitors. 2 + 3 + 8 + 2

9. a) What is Op-Amp ? State the characteristics of an ideal Op-Amp.

   b) Write a note with related mathematical derivation of Op-Amp as an integrator and differentiator.

   c) Write a brief note for logarithmic amplifier. 5 + 5 + 5

10. a) What are the advantages of class *C* amplifier ? Mention its application.

    b) Draw a circuit of a class *B* push-pull power amplifier. Derive its maximum power efficiency and collector dissipation.

    c) Derive the maximum power efficiency of a class *A* amplifier. How can its efficiency be improve ? 4 + 6 + 5

11. a) Draw the Eber's Moll model of the *p-n-p* transistor & give the equation for the emitter & collector current.

b) A given transistor with collector current 10 mA, collector to emitter volt 10 V and at room temperature has the following set of low frequency parameters :

h_{ie} = 500 ohm, $h_{oe} = 10^{-5}$ amp/V, $h_{re} = 10^{-4}$.

Find the values of all the hybrid-II parameters of low frequency model.

c) What are the early Effect ? 5 + 8 + 2

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