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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 $a) \quad \alpha \qquad \qquad b) \quad \beta$
 - c) 1+β

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- 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.

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- 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

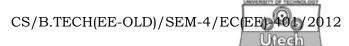
c) Pin 1

- d) No Connection (NC).
- vi) The output pulse width for a monostable multivibrator using IC 555 where external resistance & capacitance are 20 k Ω & 0·1 μF is
 - a) 2.1 s

b) 2 ms

c) 2.5 ms

d) $2.2 \mu s$.



- vii) A differential amplifier has $R_1=10~{\rm k}\Omega$ (equal both collector), $h_{ie}=1~{\rm k}\Omega$, $R_e=50~{\rm k}\Omega$, $h_{fe}=100$. The common mode gain is
 - a) 500

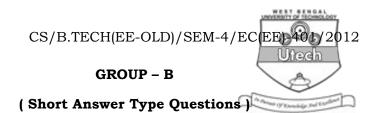
b) 2

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.

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- 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.



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.

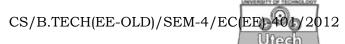
 $3 \times 15 = 45$

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

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- b) Draw the circuit and explain the operation of an Monostable multivibrator using a 555 Timer. 6
- c) In 555 Timer monostable multivibrator using $R = 100 \text{ k}\Omega$ and time delay = 100 μ s, calculate the value of c.
- 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

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- 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:

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

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

c) What are the early Effect?

5 + 8 + 2
