

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.TECH(EE)(EEE),(ICE)(N)/SEM-3/EC(EE)-301/2012-13**

**2012**

**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 regulated power supply should have regulation which is
- |            |         |
|------------|---------|
| a) maximum | b) 50%  |
| c) zero    | d) 75%. |
- ii) Thermal Runaway in a transistor is due to
- |  |
|--|
| a) heating of the transistor   |
| b) changes in $\beta$ which increases with temperature                         |
| c) increase in reverse collector saturation current due to rise in temperature |
| d) none of these.  |

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- iii) In amplifier blocking capacitors are used
- a) to increase the bandwidth
  - b) to match the impedance
  - c) to increase the gain
  - d) to avoid dc mixing with input or output.
- iv) The condition of oscillation is
- a)  $A\beta = 1$
  - b) feedback must be regenerative
  - c) phase angle must be zero or integral multiple of  $360^\circ$
  - d) all of these.
- v) The expression of closed loop gain ( $A_f$ ) for negative feedback amplifier is
- a)  $\frac{A}{1 + A\beta}$
  - b)  $\frac{A}{1 - A\beta}$
  - c)  $\frac{1}{1 + A\beta}$
  - d)  $\frac{1}{1 - A\beta}$
- vi) A Schmitt trigger uses
- a) Negative feedback
  - b) Positive feedback
  - c) Pull up resistor
  - d) Compensating capacitor.
- vii) Differential amplifier can be used to amplify
- a) only a.c. signal
  - b) only d.c. signal
  - c) both a.c. and d.c. signal
  - d) none of these.

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viii) Most efficient power amplifier is

- a) class A
- b) class B
- c) class C
- d) class AB.

ix) The maximum theoretical efficiency of a push-pull class B power amplifier is

- a) 50%
- b) 78.5%
- c) 60%
- d) 25%.

x) Which one of the following feedback topologies offer high input impedance ?

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

xi) In the astable multivibrator the capacitor charges upto

- a)  $\frac{1}{3} V_{cc}$
- b)  $\frac{2}{3} V_{cc}$
- c)  $V_{cc}$
- d) none of these.

xii) In VCO, the frequency is dependent on the value of

- a) Resistance
- b) Capacitance
- c) Voltage
- d) None of these.

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**GROUP - B**

**( Short Answer Type Questions )**

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

2. a) Explain the need of biasing of a transistor.  
  
b) Draw any one type of transistor biasing arrangement and determine its stability factor.  $2 + 3$
3. Draw the  $h$ -parameter equivalent circuit of low frequency  $CE$  mode transistor amplifier and hence calculate the current gain in terms of  $h$ -parameters.  $2 + 3$
4. What is VCO ? What are the basic differences between VCO and fixed frequency oscillator ?  $2 + 3$
5. What is cross-over distortion ? How does cross-over distortion arise in class  $B$  power amplifier ? Suggest one method to avoid cross-over distortion.  $1 + 3 + 1$
6. Draw the electrical equivalent circuit of a vibrating crystal and state the significance of each component. What are  $f_s$  and  $f_p$  ?  $3 + 2$

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**GROUP - C**

**( Long Answer Type Questions )**

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

7.
  - a) Describe the working principle of  $\pi$ -filter with diagram.
  - b) Draw the circuit of a shunt regulator and explain its operation.
  - c) What are the merits of switched mode power supply ( SMPS ) over regulated power supply ? With the help of a neat circuit diagram briefly explain the operation of switched mode power supply.  $4 + 5 + ( 1 + 5 )$
8.
  - a) Why voltage divider bias circuit is known as self bias circuit ? A silicon transistor with  $\beta = 50$ ,  $V_{BE} = 0.6 \text{ V}$ ,  $V_{CC} = 22.5 \text{ V}$  and  $R_C = 5.6 \text{ K}\Omega$  is used for self biasing circuit. It is desired to establish a  $Q$  point at  $V_{CE} = 12\text{V}$ ,  $I_C = 1.5 \text{ mA}$  and a stability factor  $S \leq 3$ . Find  $R_E = R_1$  and  $R_2$   
  
( The symbols have their usual meanings ).
  - b) Find the upper cut-off frequency of a two stage common-emitter RC coupled amplifier. A two stage common-emitter RC coupled amplifier uses transistor of the type BC 149 C of which the  $h$ -parameters and the internal capacitances are  $h_{fe} = 600$ ,  $h_{ie} = 10 \text{ k}\Omega$ ,  $C_{bc} = 2.5 \text{ pF}$ ,  $C_{be} = 9 \text{ pF}$ . If the coupling capacitor is  $0.5 \text{ }\mu\text{F}$  and the load resistance is  $10 \text{ K}\Omega$ . Find the upper cut-off frequency and its gain.  $( 2 + 5 ) + ( 4 + 4 )$

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9. a) Give the circuit of colpitt's oscillator and explain its operation. Derive the condition for sustained oscillation and the expression for the frequency of oscillation of it.
- b) What is the difference between Hartley and colpitt's oscillator.
- c) An Hartle oscillator is designed with  $L_1 = 20 \mu\text{H}$ ,  $L_2 = 2\text{mH}$  and a variable capacitor. Determine the range of capacitance values if the frequency is varied between 950 2050 kHz. ( 5 + 5 ) + 2 + 3
10. a) What is power amplifier ? How does it differ from a voltage amplifier ?
- b) Explain with circuit diagram the operation of a transformer coupled class A power amplifier and calculate its maximum power efficiency.
- c) Two transistor operate in class B push pull circuit with a collector supply voltage  $V_{cc} = 15$  volt. The turns ratio of the output transformer is 3 : 1 and the load resistance is 9 ohm. Determine maximum dc power supplied and the maximum output power. Also find out efficiency. 3 + 7 + 5
11. a) What are the criteria of a good instrumentation amplifier ? Describe the steps for building an instrumentation amplifier starting from the basic differential amplifier.

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b) Draw the circuit diagram of an astable multivibrator using 555 timer and derive the expression of its frequency of oscillation.

c) For an astable multi-vibrator using 555 timer,  $R_A = 6.8 \text{ K}\Omega$ ,  $R_B = 3.3 \text{ K}\Omega$  and  $C = 0.1 \mu\text{F}$ , calculate

i)  $t_{HIGH}$

ii)  $t_{LOW}$

iii) free running frequency

iv) duty cycle, D. ( 2 + 5 ) + 5 + 3

12. Write short notes on any three of the following : 3 × 5

a) PLL

b) Phase-shift oscillator

c) Tuned amplifier

d) Current mirror circuit

e) Trans-conductance multiplier.

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