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 β which increases with temperature

      c) increase in reverse collector saturation current due to rise in temperature

      d) none of these.

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°

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.

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.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 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 equaivalent circuit of a vibrating crystal and state the significance of each component. What are f_s and f_p ? 3 + 2

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Describe the working principle of π-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 $\beta = 50$, $V_{BE} = 0.6$ V, $V_{CC} = 22.5$ V and $R_C = 5.6$ KΩ is used for self biasing circuit. It is desired to establish a Q point at $V_{CE} = 12$V, $I_C = 1.5$ 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 $h_{fe} = 600$, $h_{ie} = 10$ kΩ, $C_{bc} = 2.5$ pF, $C_{be} = 9$ pF. If the coupling capacitor is 0.5 μF and the load resistance is 10 KΩ. Find the upper cut-off frequency and its gain. (2 + 5) + (4 + 4)

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 L1 = 20 μH, L2 = 2mH 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.

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 KΩ, R_B = 3.3 KΩ and C = 0.1 μF, 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.