Name : ....

Roll No. : ....

Invigilator's Signature : ....

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

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 the following :

$10 \times 1 = 10$

i) Damping factor of second order Butterworth filter is

a) 1·73 b) 1·414

c) 1·06 d) 0·5.

ii) The input offset voltage in an Op-Amp is due to

a) mismatch in transistor parameters

b) voltage irregularity

c) imperfect ground

d) none of these.

iii) If gain is A and feedback factor is β, then condition to sustain oscillation of Wein-bridge oscillator is

a) $A = 1/3, \ \beta = 3$

b) $A = 3, \ \beta = 1/3$

c) $A = 6, \ \beta = 1/6$

d) $A = 1/6, \beta = 6$.

iv) The current in FET is

a) only due to minority carriers

b) only due to majority carriers

c) due to both

d) none of these.

v) Commercially available Op-Amp is

a) IC 742 b) IC 723

c) IC 741 d) IC 555.

vi) The temperature coefficient of the Zener breakdown voltage is

a) positive b) negative

c) zero d) none of these.

vii) The CMRR of an Op-Amp is

a) much larger than unity

b) zero

c) much smaller than unity

d) unity.

viii) A BJT can act as a switch, when it changes from

a) cut-off to active region

b) active to saturation

c) forward active mode to reverse active mode

d) saturation to cut-off region.

ix) For an enhancement mode *n*-MOSFET, the threshold voltage is

a) positive b) negative

c) zero d) none of these.

x) Maximum efficiency of class *B* push-pull power amplifier is

a) 25% b) 65%

c) 78·5% d) 95%.

GROUP – B

(Short Answer Type Questions)

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

2. Draw a circuit of a class *B* push-pull power amplifier. Derive its maximum power efficiency and collector dissipation. 2 + 3

3. a) Obtain the expression for output voltage of an integrator using Op-Amp.

   b) Draw the output waveforms if input of a differentiator is

      i) Triangular wave

      ii) Sine wave. 2 + 3

4. Show that depletion width (W) of a *p*-*n* junction diode is related to applied potential V in the following way :

   $W \propto K \sqrt{V_0 - V}$ where, K is a constant and V_0 is the contact potential. 5

5. What are the differences between series and shunt regulators ? Draw a circuit of a shunt regulator and explain its operation. 2 + 3

6. What do you mean by clamping cicuit ? Draw its circuit diagram and discuss its operation.

GROUP – C

(Long Answer Type Questions)

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

7. a) Sketch the basic structure of an *n*-channel enhancement type MOSFET and explain the various parts of it.

   b) How does the name enhancement and depletion type MOSFET comes into picture ?

   c) Show the circuit symbol for both enhancement and depletion type *n*-channel MOSFET.

   d) Draw the $i_D - V_{DS}$ characteristic curve for common source configuration and indicate all the three regions of operation. $4 + 6 + 2 + 3$

8. a) What are the characteristics of Ideal Op-Amp ? Establish the relationship between slew rate and full power bandwidth.

   b) Design a circuit to implement the function $f = 3x + \log(2x) + \sin 4x$.

   c) Why hyteresis is desirable in a Schmitt Trigger Circuit ?

   d) Why multipliers are used for opeation of TV picture tube voltage rather than transformers ?

   $3 + 4 + 4 + 2 + 2$

9. a) Draw the Eber's Moll model of the *pnp*-transistor and give the equations for the emitter current and collector current. 5

b) Define and describe about LED. 5

c) Draw the small-signal high-frequency *CE* model of a transistor. How does g_m vary with $|I_C|$, $|V_{CE}|$ and $|T|$? 2 + 3

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

a) Wien Bridge Oscillator

b) Four basic feedback topolgies

c) Astable multivibrator

d) Spice model of MOSFET

e) Active Filter.

11. a) What do you mean by feedback in amplifiers ? 2

b) Derive an expression for the closed-loop gain of the amplifier with feedback. 6

c) State the assumptions made in your derivation. 3

d) Write down the effect of negative feedback in an amplifier in terms of gain, bandwidth, input resistance and output resistance with respect to voltage series configuration. 4