Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(EE-N)/SEM-4/EC(EE)-401/2010

2010

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) The gain required for sustained oscillation in Wien-bridge oscillator is

a) 29 b) 1·5

c) 3 d) 1.

ii) The function of a linear voltage regulator is to

a) minimize the change in voltage at any load condition

b) reduce the ripple at the output voltage

c) reduce the voltage fluctuation due to sudden change in load

d) supply constant current at all load condition.

iii) In typical circuits, the stabilization factor S ($\Delta I_C / \Delta I_{CO}$) is

a) < 1 b) > 1

c) = 1 d) << 1.

iv) The maximum theoretical efficiency of class *A* amplifier can be

a) 50% b) 78%

c) 25% d) 100%.

v) A differential amplifier is used at input stage of any operational amplifier to ensure

a) high CMRR b) wide bandwidth

c) high slew rate d) high open loop gain.

vi) A V-I converter is a/an

a) transconductance amplifier

b) transresistance amplifier

c) current amplifier

d) operational amplifier.

vii) 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.

viii) 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.

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

a) match the impedance

b) control frequency

c) limit bandwidth

d) prevent *dc* mixing with the output.

x) 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).

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

a) 2·1 sb) 2 ms

c) 2·5 ms d) 2·2 μs.

xii) A push-pull amplifier balances out

a) odd harmonics

b) even harmonics

c) odd as well as even harmonics

d) neither odd nor even harmonics.

xiii) A quiescent state of transistor implies

a) zero bias b) no output

c) no distortion d) no input signal.

xiv) An ideal regulated power supply should have regulation which is

a) maximum b) 50%

c) zero d) 75%.

xv) A MOSFET differs form 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.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 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 and thermal run-away. Draw and 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 a constant current I_o.

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 and non-inverting amplifier. What is buffer ?

GROUP – C
(Long Answer Type Questions)

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

7. a) Draw and explain the self bias circuit for a BJT. 6

   b) For the two-battery transistor circuit shown, prove that the stabilization factor S is given by

$$S = \frac{1 + \beta}{1 + \beta R_e / (R_e + R_b)} .$$ 6

dia.

   c) Define load line and Q-point. Why is the line called 'load line' ? 2 + 1

8. a) What do you mean by the conversion efficiency of a power amplifier ? 2

b) Draw the circuit of a Class *B* push-pull power amplifier and show that its maximum power efficiency is 78·5%. 8

c) Explain with a neat diagram the working of a Class *C* tuned power amplifier. 5

9. a) Draw and explain the operation of a monostable multivibrator using 555 timer. 5

b) With a neat diagram explain the operation of a square wave generator and hence prove that the frequency of oscillation depends only on external components used. 5

c) Draw and explain the operation of a clipper circuit using Op-Amp. 5

10. a) What is a voltage regulator ? Write down the advantages of adjustable voltage regulator over fixed voltage regulators. 2 + 3

b) With a proper circuit diagram explain the operation of a series voltage regulator. 5

c) Explain the operation of a current mirror circuit. 5

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

a) Current mirror

b) SMPS

c) PLL

d) Wave shaper

e) Enhancement MOSFET.