2018

M.Sc. 1st Seme. Examination

ELECTRONICS

PAPER—ELC-104

Full Marks : 50

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Analog Electronics

Group–A

1. Answer any *four* questions : 4×2

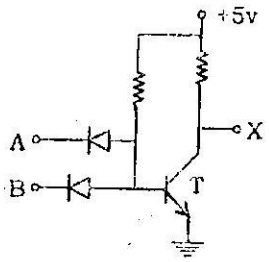
(a) If the differential voltage gain and common mode voltage gain of a differential amplifier are 48 dB and 2 dB respectively, then find out its common mode rejection ratio.

(b) State and explain Miller Theorem.

(c) Describe thermal runway of a transistor.

(d) Implement $y = \overline{AB(C + D)}$ using CMOS.

(e) Identify the logic circuit shown below :



(f) Write two advantages of crystal controlled oscillator.

(g) Draw a voltage regulator circuit using op-amp.

(h) Define Q point of a transistor.

Group–B

2. Answer any *four* questions : 4×4

(a) By proper circuit diagram explain triangular wave generator and calculate output frequency. 3+1

(b) Write down operating principles of PLL by using proper block diagram.

(c) Explain the operation of a switched mode power supply with proper diagrams. Write its advantages over series regulated power supplies.

(d) Draw the circuit diagram of a common collector transistor amplifier and explain how this can behave as an emitter follower.

(e) How transistor works as an amplifier ? Explain it using proper VTC curve. 2+2

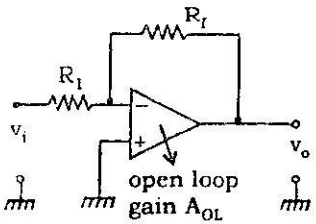
(f) Show that if a MOSFET is used as a switch, its ON resistance can be expressed as

$$(r_{ds})_{ON} = \frac{1}{\mu C_{ox}\left(\frac{W}{L}\right)(V_{GS} - V_{Th})},$$

when $V_{DS} << (V_{GS} - V_{Th})$. The symbols have usual meanings.

(g) Explain series voltage regulator circuit using op-amp.

(h) Find the expression for the voltage gain of the following inverting OP-Amp circuit :

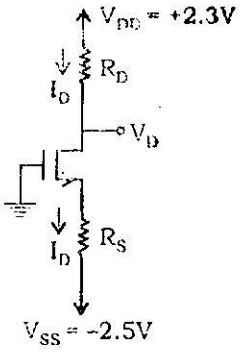


Group–C

3. Answer any *two* questions : 2×8

(a) (i) Explain channel length modulation of a MOSFET.

(ii) Design the circuit of figure below, that is, determine the values of R_D and R_S so that the transistor operates at I_D = 0.4 mA and V_D = + 0.5V. The NMOS transister has $V_t = 0.7V$, $\mu_n cox$ = 100 mA/V^2, L = 1 μm and W = 32 μm. Neglect the channel-length modulation effect (i.e., assume that λ = 0).



4+4

(b) (i) How op-amp act as a comparator ? Briefly discuss with proper circuit diagram and give input-output waveform.

(ii) Explain Schmitt trigger circuit. (2+2)+4

(c) Draw Common-Emilter (CE) amplifier circuit. Replace the basic circuit by its hybrid-a model. Derive input impedance, output impedance, voltage gain and current gain. 1+1+2+2+2

(d) (i) What is an instrumentation amplifier and why this is needed ? Draw the circuit diagram of an instrumentation amplifier using 3 OP-Amps and derive the expression for its output voltage in terms of input voltages.

(ii) Explain how a current mirror circuit is realised using low-β transistors in the architecture of an OP-Amp. 5+3

Internal Assessment — 10