PG/IS/ELC-104/19

M.Sc. 1st Semester Examination, 2019

ELECTRONICS

(*Analog Economics*)

PAPER –ELC-104

Full Marks : 50

Time : 2 hours

The figures in the right-hand margin indicate marks

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

Illustrate the answers wherever necessary

1. Answer any *four* questions : 2×4

(*a*) In Fig(a) below, given that $R_1 = 10\ k\Omega$, $R_f = 100\ k\Omega$, $V_i = 1V$. A load of $25\ k\Omega$ is connected to the output terminal. Calculate (*i*) i_1 (*ii*) v_0 (*iii*) i_L and total current i_0 into the output pin. 2

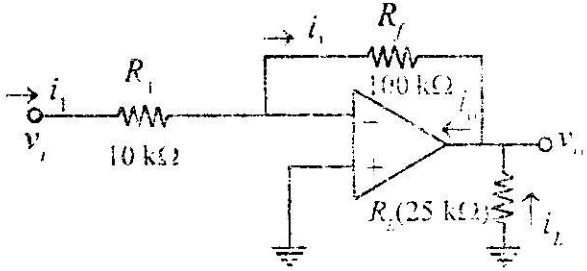


Fig (*a*)

(*b*) Fig (*b*) shows a diode logic circuit. Write its truth table and mention its logic operation. 2

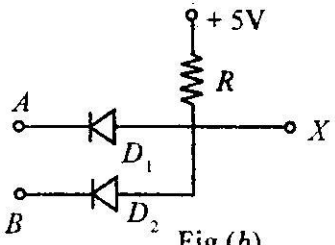
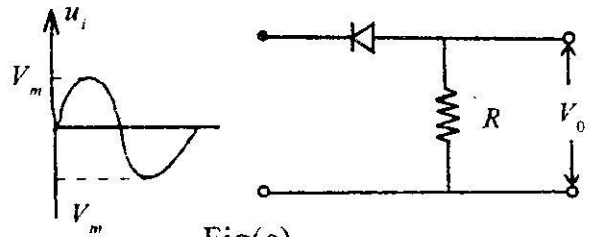


Fig (*b*)

(*c*) What will be the output of the following circuit in Fig(c) ? 2

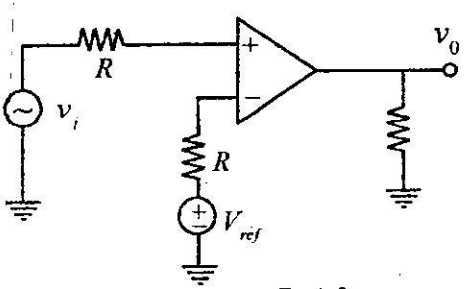


Fig(c)

(*d*) Write two advantages of Switch mode power supply (SMPS) over linear power supply. 2

(*e*) What is the importance of stabilization of *Q* point ? 2

(*f*) What will be the output of the following fig(*d*) ? 2



fig(*d*)

(*g*) How a PLL can be used as an FM demodulator ? Write its advantages over conventional FM discriminators. 1 + 1

(*h*) Implement $y = \overline{AB + C}$ by using CMOS. 2

2. Answer any *four* questions : 4 × 4

(*a*) By proper circuit *diagram explain square*

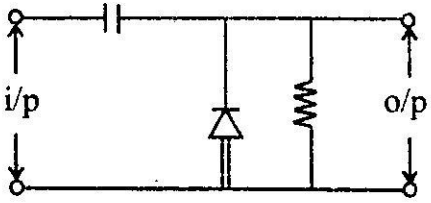
wave generator circuit and derive the expression for its output frequency. 1 + 3

(*b*) Explain series regulator circuit using op-amp. 4

(*c*) How does a MOSFET work as an amplifier circuit ? Explain it using proper VTC curve. 4

(*d*) Which method gives best stability ? Explain it using proper circuit diagram. 1 + 3

(*e*) Explain clamper circuit given below. Show the O/P waveform. 4

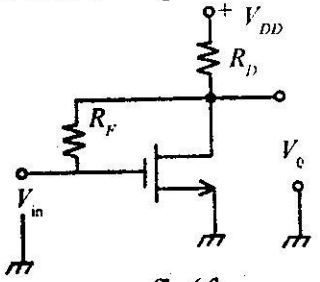


Fig(*e*)

(*f*) Explain principle operation of VCO by proper circuit diagram. 4

(g) Draw different topologies of feedback amplifier circuit. 4

(*h*) Derive the expression for the small signal voltage gain of the following common source MOS Amplifier. 4



fig(*f*)

3. Answer any *two* questions : 8×2

(*a*) (*i*) Consider the circuit shown in Fig $g(a)$ which is redrawn in Fig. $g(b)$. Analyze the circuit to determine all node voltages and branch currents. $\beta = 100$ (given)

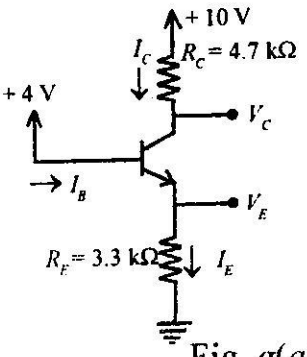


Fig. $g(a)$

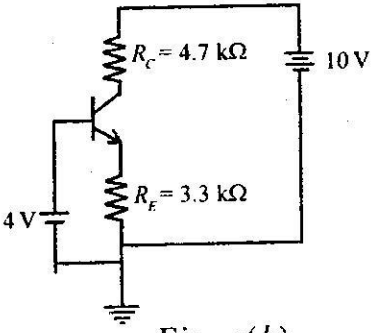
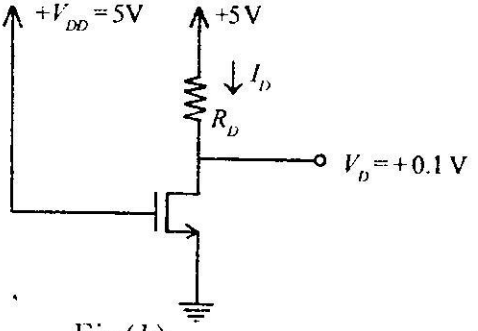


Fig. g(b)

(*ii*) Write down thermal Runway of a BJT. 6 + 2

(*b*) (*i*) Draw small signal model of a MOSFET.

(*ii*) Design the circuit shown in Fig(*h*) to establish a drain voltage of 0.1 V. What is the effective resistance between drain and source at the operating point ? Let $v_{th} = 1\,V$ and $K'_n(W/L) = 1\ mA/V^2$.



Fig(*h*)

2 + 6

(*c*) (*i*) Draw the circuit diagram of an emitter coupled differential amplifier and derive the expression for its CMRR.

(*ii*) Explain how a current mirror circuit is designed using low β transistors in the

design of an op-amp with proper circuit diagram and necessary derivation. (1 + 3) + (1 + 3)

(*d*) (*i*) With suitable circuit diagram, explain the operation of R-C coupled transistor amplifier. Mention function of all its components.

(*ii*) Explain the principle of operation of Darlington amplifier. 5 + 3

[*Internal Assessment* : 10 Marks]
