B. TECH

FIFTH SEMESTER EXAMINATION, 2002-2003
ANALOG INTEGRATED CIRCUITS

Time : 3 Hours .   *Total Marks : 100*

Note :(1) Attempt **ALL** questions.

(2) Make suitable assumptions wherever required and justify.

1. Answer any TWO of the following :—   (10 × 2 = 20)

    (*a*) (*i*) Define Common Mode Rejection Ratio and explain its significance with respect to differential amplifier.
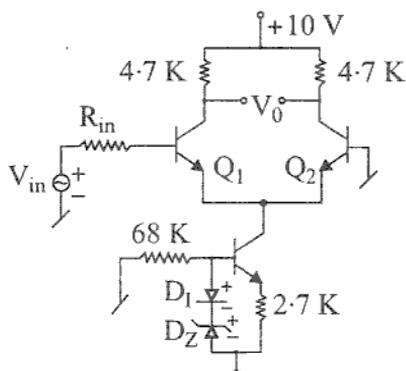
    (*ii*) For the circuit as shown in Fig. 1, $\beta_{ac} = \beta_{dc} = 100$, $V_{BE} = V_{D1} = 0.715$ V, $V_Z = 6.2$ V, $I_{Zt} = 41$ mA, calculate :

    (*a*) voltage gain of differential amplifier,

    (*b*) input resistance,

    (*c*) operating point values I_{CQ} and V_{CEQ}.

Fig. 1

(b) (i) Why are current mirrors used in biasing ?

(ii) In Fig. 2, a transistor array CA3086 is used and $\beta_{dc} = \beta_{ac} = 100$ and $V_{BE} = 0.715V$, find collector current of each transistor.
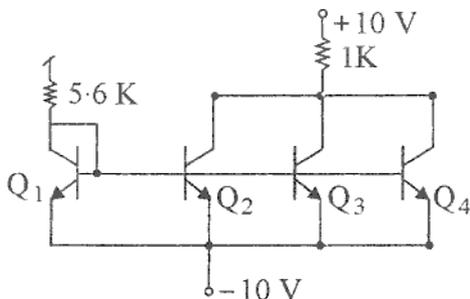

Fig. 2

(c) Explain the working of op-amp 741 schematic diagram with a neat sketch.

2. Answer any TWO of the following :— (10×2=20)

(a) Find $\dfrac{V_{01}}{V_{in}}$, $\dfrac{V_{02}}{V_{in}}$ and $\dfrac{V_{03}}{V_{in}}$ for Fig. 3 in terms of circuit parameters. Also explain, what these transfer functions represent. Assume all operational amplifiers to be ideal.
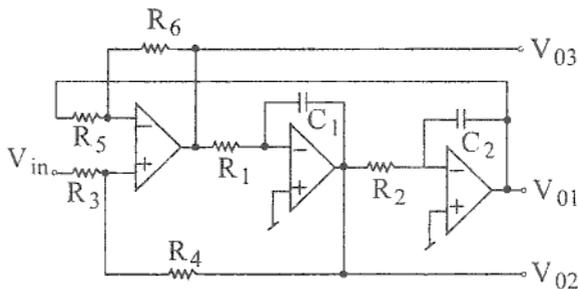

Fig. 3

(b) (i) Explain the working of the following with neat diagrams :—

(1) Non-inverting VCVS

(2) CCVS

(ii) Design a second order Butterworth active low pass filter for a cut-off frequency of 1·0 kHz.

(c) Consider Fig. 4 and ideal op-amp.

(i) Compute condition of oscillation.

(ii) Find the frequency of oscillation.

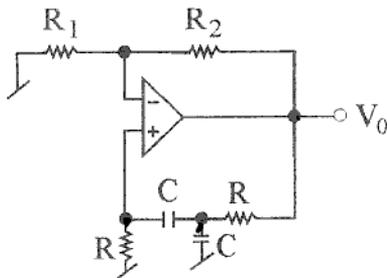
Fig. 4

3. Answer any FOUR of the following :—   (5×4=20)

(a) Derive the output expression of Log-amplifier using op-amp as active device.

(b) Draw Sample and Hold circuit using op-amp and explain its working.

(c) Explain how a Schmitt trigger works with a neat diagram.

(d) Draw and explain the circuit of square and triangle wave generator using op-amp and also draw the waveforms at various nodes of the circuit diagram.

(e) Draw and explain the working of Monostable Multivibrator using op-amp.

(f) Draw the circuit of a precision rectifier and explain its working.

4. Answer any FOUR of the following :— (5×4=20)

(a) What is the function of a voltage regulator ? Draw the op-amp voltage regulator circuit and explain its working.

(b) Explain with neat sketch, the current limiting features of 723 voltage regulator.

(c) Draw the block diagram of SMPS and explain its working.

(d) Explain the current fold back characteristics with respect to 723.

(e) List the characteristics of an Operational Transconductance Amplifier (OTA). Draw the inverting and non-inverting amplifiers using OTA.

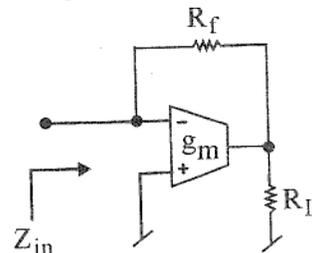(f) Find the input impedance of circuit as shown in Fig. 5.

Fig. 5

5. Answer any TWO of the following :— (10×2=20)

(a) Explain the block diagram of 555. Derive the expression for time delay of a monostable multivibrator using 555.

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(b) (i)   Explain Lock-in Range, Capture Range and Pull-in-time of a PLL.

(ii) Draw the block diagram of a PLL and explain its working.

(iii) List the applications of PLL.

(c) (i)   Write note on Programmable Gain Amplifier.

(ii) Enlist the applications of Analog Switches. Select one application and explain its working with a neat sketch of the circuit.

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