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BIEL-002

B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

00356

June, 2016

BIEL-002 : ANALOG AND INTEGRATED CIRCUITS DESIGN

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks. Missing data may be suitably assumed and mentioned. Use of scientific calculators is permitted.*

1. Draw the circuit diagram of a dual-input, unbalanced-output differential amplifier. Derive the expression for I_{C_Q} and V_{CE_Q} using DC analysis. Also derive an expression for its voltage gain, input resistance and output resistance using AC analysis. *10*

2. What is the need for constant-current bias circuit in the design of differential amplifiers ? Explain the operation of a constant-current bias circuit using zener diodes with the help of a neatly labelled circuit diagram and necessary mathematical steps. *3+3+4=10*

3. (a) Give the circuit diagram of a voltage-to-current converter with grounded load. Also prove that the load current (I_L) is directly proportional to the input voltage (V_{in}). *2+3=5*

(b) Calculate the voltage at points A and B shown in Figure 1, when V_1 = 5 V and V_2 = 5·1 V. Take R = 100 kΩ. *5*

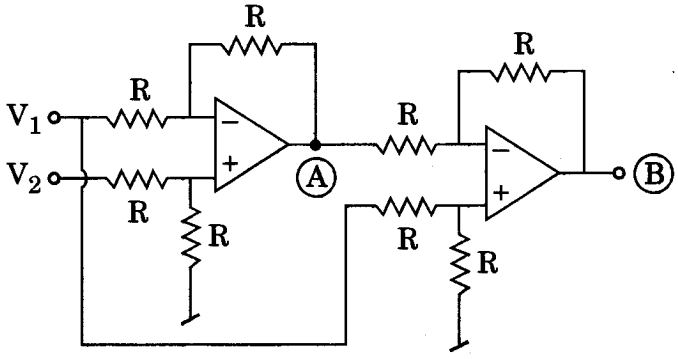

Figure 1

4. (a) Show that the circuit shown in Figure 2 is a non-inverting integrator. *5*

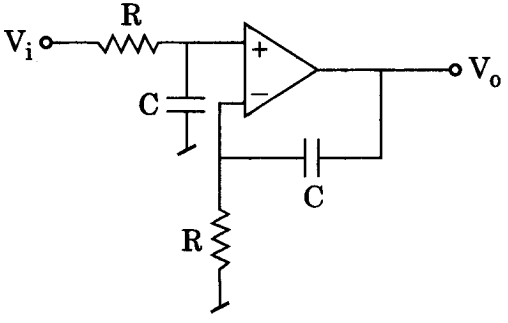

Figure 2

(b) For the circuit shown in Figure 3, it is found that $V_0 = a_1V_1 + a_2V_2 + a_3V_3$. Find the values of a_1, a_2 and a_3. 5

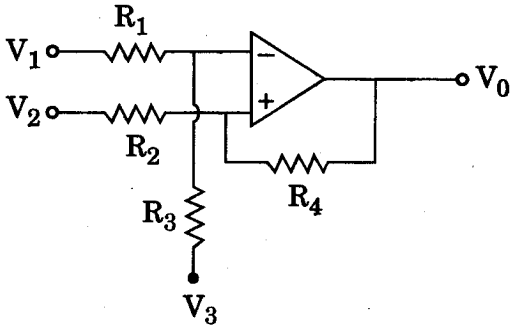

Figure 3

5. Explain the operation of a precision full-wave rectifier circuit using an op-amp with the help of neatly labelled circuit diagrams, input-output waveforms and necessary mathematical calculations. *10*

6. Give the circuit diagram of a Triangular-Wave Generator that utilizes lesser number of components. Prove that the frequency of triangular-waves is given by the expression

$$f_0 = \frac{R_3}{4\,R_1\,R_2\,C_1}.$$ *10*

7. What are regenerative comparators ? Explain their operation with the help of neatly labelled circuit diagrams and waveforms. Prove that the hysteresis voltage is given as

$$V_H = \left(\frac{2R_2}{R_1 + R_2}\right)(+V_{sat}).$$ *10*

8. Draw the circuit diagram of a second order Sallen-Key low pass filter. Derive an expression for its transfer function and find various filter parameters. *10*

9. Define a logarithmic amplifier and give its basic diagram. What are the drawbacks of the above circuit ? How are they modified in the other form of log amplifiers ? Explain. *10*

10. Write short notes on any ***two*** of the following : *2×5=10*

    (a) PLL as FSK Demodulator

    (b) Clippers using Op-Amps

    (c) Offset Nulling Techniques