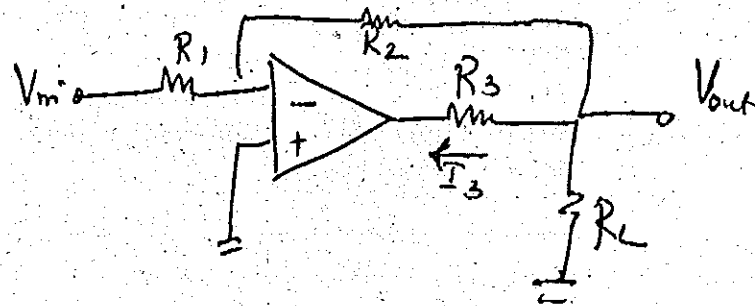(b) (i) Explain the issues and challenges in active filter design with example. (5)

(ii) The circuit given is inverting amplifier except the resistor R_3 is added. The circuit parameters are $R_1 = 5$ kΩ, $R_2 = 25$ kΩ, $R_3 = 12.5$ kΩ, $R_L = 5$ kΩ.

(1) Derive V_{out} expression.

(2) Derive expression for I_3.

(3) What happens to I_3 if R_3 is doubled? (($R_3 = 25$ kΩ) (10)

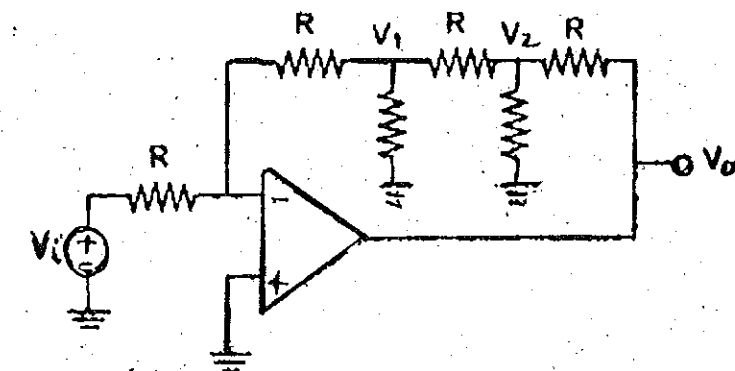Time : Three hours   Maximum : 100 marks

(Codes / Tables / Charts to be permitted, if any may be indicated)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the significance of current mirror circuit.

2. Mention the application of LF155.

3. Find the gain of V_o / V_i of the circuit.

4. How does a zero crossing detector work?

5. What is Gilbert multiplier cell?

6. List the basic building blocks of PLL.

7. Define settling time.

8. What is the largest value of output voltage from an 8-bit DAC that produces 1.0 V for a digital input of 00110010?

9. What are the types of multivibrator?

10. State the function of Opto coupler.

PART B — (5 × 13 = 65 marks)

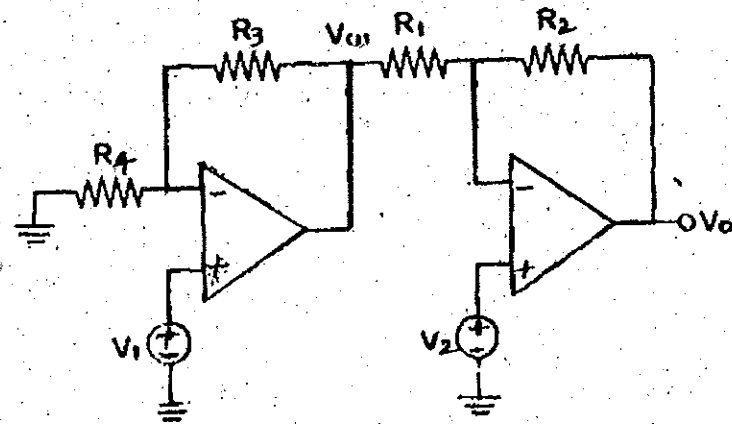11. (a) List and explain the function of all the basic building blocks of an op-amp.

Or

(b) Explain the DC and AC performance characteristics of Op Amp.

12. (a) Explain the operation of

(i) Schmitt Trigger (7)

(ii) Precision rectifier. (6)

Or

(b) Find V_0. Verify that if $R3/R4 = R1/R2$, the circuit is an instrumentation amplifier with gain $A = 1 + R2/R1$.

13. (a) Explain PLL characteristics and derive the lock range and capture range equations.

Or

(b) Explain any two applications of PLL.

14. (a) (i) Assume the following values for the ADC clock frequency = 1 MHz; DAC has F.S. output = 10.23 V and a 10-bit input. Determine the following values :

(1) The digital equivalent obtained for the input voltage VA = 3.728 V.

(2) The conversion time.

(3) The resolution of this converter in percentage. (9)

(ii) A 10-bit DAC has a step size of 10 mV. Determine the full-scale output voltage and the percentage resolution. (4)

Or

(b) Explain the working of R-2R ladder DAC with a circuit schematic. List converter characteristics.

15. (a) Explain the working principle of Triangular wave generator circuit using op amp and mention its application.

Or

(b) Explain the following ICs function and application : (i) Audio Power Amplifier (ii) Video Amplifier.

PART C — (1 × 15 = 15 marks)

16. (a) (i) Suppose that an amplifier with input resistance of 500 kΩ or greater is needed and a voltage gain of −10. The feedback resistors are to be implemented in integrated form and have values of 10 kΩ or less to conserve chip area. Choose a suitable circuit configuration and specify the resistance values. Finally, estimate the resistor tolerance needed so that the gain magnitude maintained within 5% of its nominal values. (7)

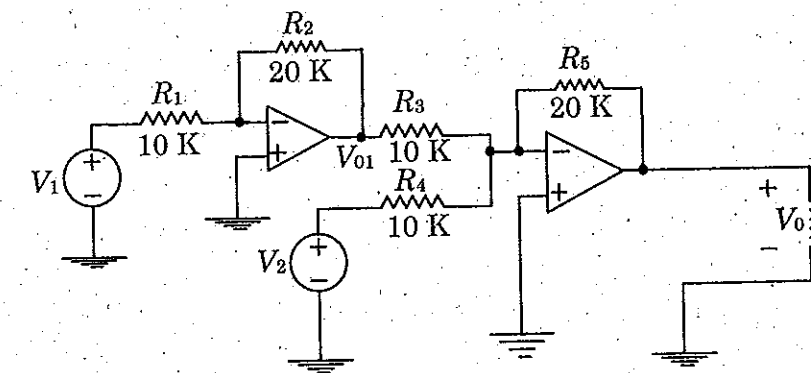(ii) Find the output expression for the figure shown. (8)

Fig. 16 (a) (ii)

Or