

- N.B.** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions from remaining **six** questions.
 (3) Assume **suitable** data if **required** and **state** it **clearly**.

1. Solve any **four** :— 20
 - (a) For an inverting amplifier with $R_1 = 1 \text{ K}\Omega$ and $R_F = 15 \text{ }\Omega$, the op-amp parameters are $A_V = 2 \times 10^5$, $R_i = 2 \text{ M}\Omega$, $R_o = 75 \text{ }\Omega$ and bandwidth = 5 Hz. Calculate the values of A_{VF} , R_{iF} , R_{oF} and the Bandwidth with feedback.
 - (b) The slew rate of an op-amp is $6 \text{ V}/\mu\text{s}$ when the closed loop gain is unity. If the output signal is $V_o = V_m \cos \omega t$, find the limiting frequency which will distort the output signal by the slew rate limit if — (i) $V_m = 1 \text{ V}$ and (ii) $V_m = 10 \text{ V}$.
 - (c) In an inverting op-amp adder if 3 voltages if $V_1 = +1 \text{ V}$, $V_2 = +3 \text{ V}$ and $V_3 = +2 \text{ V}$ with $R_1 = R_2 = R_3 = 2 \text{ K}\Omega$ and $R_F = 10 \text{ K}\Omega$, determine the output voltage.
 - (d) For an RC phase shift oscillator, the component values are $R = 8.2 \text{ K}\Omega$, $C = 0.01 \text{ }\mu\text{F}$, $R_1 = 1.2 \text{ K}\Omega$, $R_F = 39 \text{ K}\Omega$.
 - (i) Determine whether we can get sustained oscillations.
 - (ii) What will be the frequency of oscillations.
 - (e) For a non-inverting schmitt trigger, calculate the component values, for a Hysteresis width of 6 V. Assume the saturation voltage to be $\pm 12 \text{ V}$.
2. (a) Draw the circuit diagram and explain multiplication and division of two analog signals. 10
 (b) Explain an integrator circuit using OP-amp. If RC time constant is 1 msec. and input to the integrator is a square wave of frequency 1 KHz, $V_{PP} = 2 \text{ V}$, draw the output waveform. Assume V_o at $t = 0$ as 0 V. 10
3. (a) Design an astable multivibrator using IC 555 with 50% duty cycle without using a diode. 10
 (b) Explain with the help of neat diagram the operation of a negative peak detector circuit using OP-amp. 10
4. (a) Design a voltage regulator using IC 723 to regulate the output voltage between 4 V to 20 V and output current of 100 mA. 10
 (b) Draw the circuit diagram of a Dual slope ADC. Explain its working with neat sketches. 10
5. (a) Draw the circuit diagram of three OP-amp instrumentation amplifier. Get an expression for the output. 10
 (b) Draw the circuit diagram to generate square and triangular waveform using OP-amp. Derive an expression for frequency and state the limitation on the frequency range of operation. 10
6. (a) Derive the expression for Q and cutoff frequency for second order low pass KRC filter. 10
 (b) Draw a neat functional diagram of PLL IC 565 and explain the following terms along with the working of the PLL :— 10
 - (i) Free running frequency
 - (ii) Capture range
 - (iii) Lock range.
7. Write notes on (any **two**) :— 20
 - (a) IC 8038
 - (b) Gyator
 - (c) Precision Rectifier
 - (d) Switching Voltage Regulators.