

This question paper contains 4 printed pages]

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S. No. of Question Paper : 1092

Unique Paper Code : 251403

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Name of the Paper : Analog Electronics—II [ELHT-402]

Name of the Course : B.Sc. (Hons.) Electronics

Semester : IV

Duration : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Question No. 1 is compulsory.

Attempt *Five* questions in all.

All questions carry equal marks.

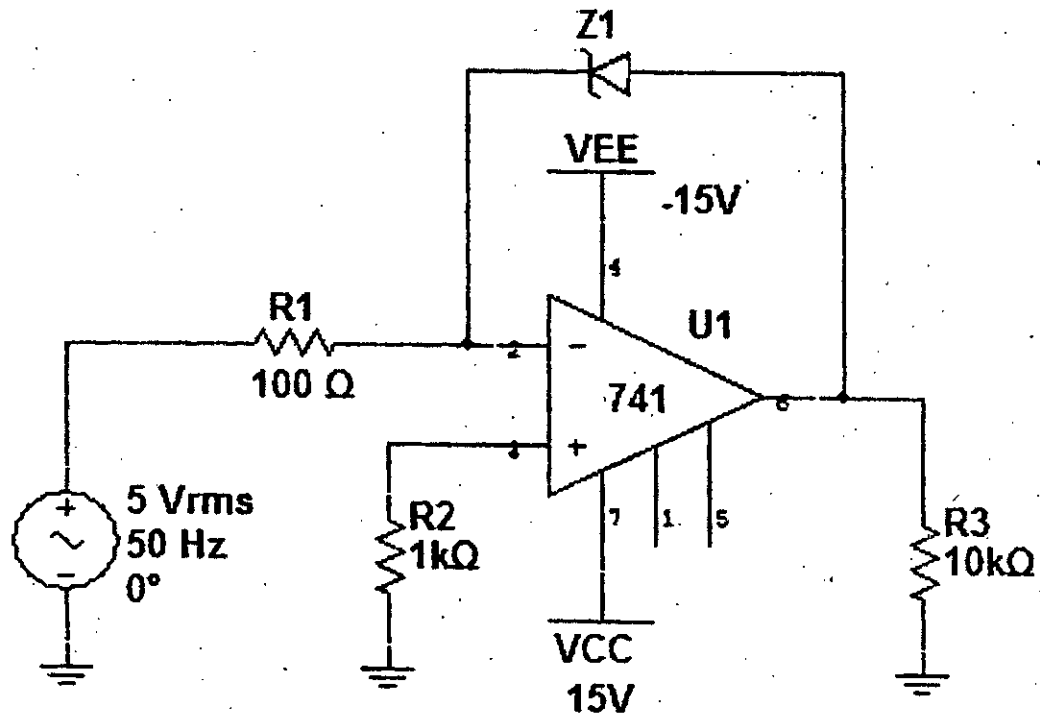
Use of scientific calculator is allowed.

1. (a) Why is an open loop operational amplifier unsuitable for linear applications? List all four negative feedback configurations.
- (b) Give equivalent circuit diagram as well as high frequency model of an operational amplifier.
- (c) Design a summing scaling amplifier to generate :

$$V_{\text{out}} = -(2.V_a + 3.V_b).$$

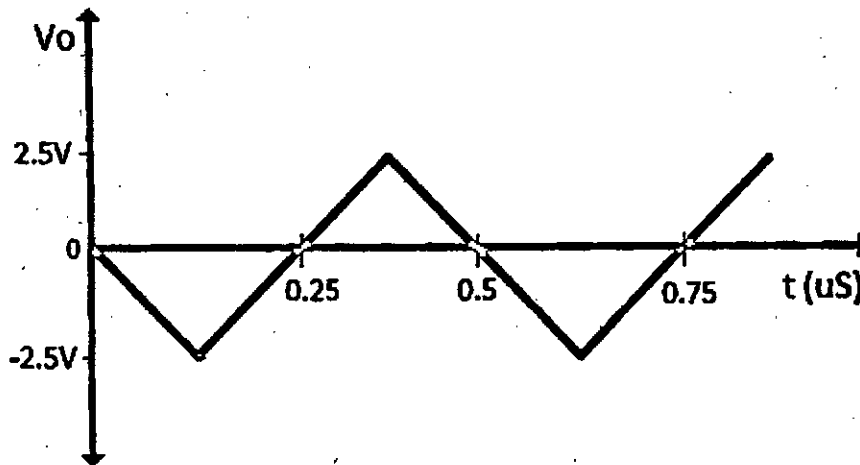
P.T.O.

- (d) Draw the output waveform for the given circuit (assume $V_z = 5\text{ V}$ and $V_d = 0.7\text{ V}$).



- (e) What is an all pass filter ? Draw its circuit diagram. 3×5=15
2. (a) Derive expressions for voltage gain (A_f), input resistance (R_{if}), output resistance (R_{of}) and bandwidth (f_p) of voltage shunt feedback amplifier using op-amp. 8
- (b) How voltage shunt feedback amplifier is modified to be used as current to voltage converter (with the circuit diagram) ? 3
- (c) Design a subtractor using operational amplifier in difference amplifier mode. 4
3. (a) Design an integrator that can integrate signals between frequencies 2 kHz to 20 kHz. Draw and explain its frequency response. 8
- (b) Derive an expression for the output of a basic differentiator. What are limitations of this circuit ? 5
- (c) What is the significance of relatively large value of CMRR ? 2

4. (a) Design an astable multivibrator using 555 timer to generate a rectangular wave of frequency 10 kHz with duty cycle 80%. Modify this circuit to generate a square wave. 7
- (b) Design a frequency divider circuit using 555 timer in monostable multivibrator mode so that $f_{out} = 0.5 f_{in}$, where $f_{in} = 2.5$ kHz. 5
- (c) Draw and discuss the frequency response of first and second order low pass filter with same pass band gain A_f and bandwidth f_H . 3
5. (a) Define slew rate. When a square wave of 8 V_{pp} voltage and 2 MHz frequency is applied at input of a voltage follower circuit, the output is a triangular wave as shown below, calculate its slew rate. 4



- (b) Design a wide band reject filter with $f_L = 500$ Hz and $f_H = 2$ kHz and pass band gain of 5. 7
- (c) Draw block diagram of PLL (Phase Lock Loop). Define its free-running and capture states. 4

6. (a) Design a Wien bridge oscillator to generate a signal of frequency 500 Hz. 5
- (b) What is the difference between basic and regenerative comparator? Design a regenerative comparator with threshold voltages as $V_{ut} = +1V$ and $V_{lt} = -1V$. 6
- (c) Draw circuit diagram of triangular wave generator. How can this be used to generate sawtooth wave? 4
7. (a) Give circuit diagram of exponential amplifier and explain its operation. 6
- (b) What is offset minimizing resistance (R_{om})? Why is it not needed in differential op-amp circuits? 3
- (c) Compute the maximum total output offset voltage in the inverting amplifier with $R_1 = 1\text{ k}\Omega$ and $R_f = 4\text{ k}\Omega$ before and after connecting offset minimizing resistance (R_{om})? 6
- (Assume $V_{io} = 7.5\text{ mV max.}$, $I_{io} = 50\text{ nA max.}$ and $I_B = 250\text{ nA max.}$ at $T = 25^\circ\text{C}$).