B.Sc. Semester-IV Examination, 2022-23

ELECTRONICS [Honours]

Course ID : 41711 Course Code : SH/ELC/401/C-8(T-8)

Course Title : Operational Amplifiers and Applications

Time : 1 Hour 15 Minutes Full Marks : 25

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer any **three** of the following: 1×3=3

   a) Draw the voltage transfer curve of an ideal and practical op-amp.

   b) What is Zero Crossing Detector (ZCD)?

   c) Why is op-amp called operational amplifier?

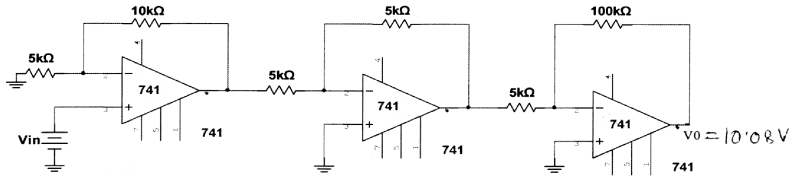
   d) What is differential amplifier?

   e) Draw the circuit diagram of sample and hold circuit.

   f) The gain of buffer amplifier is unity.– Explain.

2. Answer any **three** of the following: 2×3=6

   a) Calculate the input voltage if the final output V_0 is 10.08 volts.



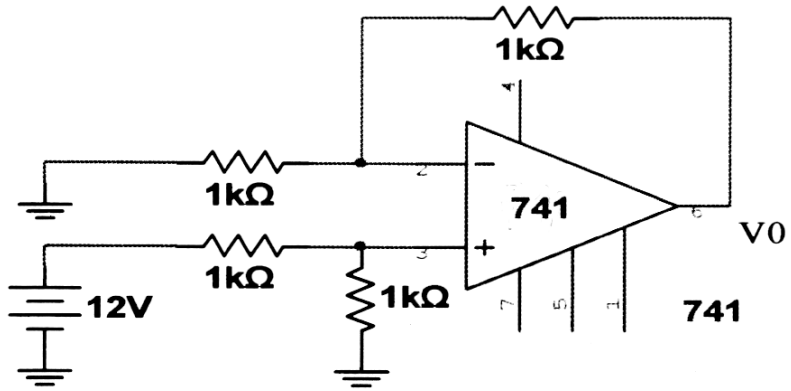
   b) With a neat circuit diagram, show how can you obtain an output which is proportional to the multiplication of two input signals.

   c) What is op-amp Integrator? Sketch the output of an op-amp integrator if the input is a step signal.

   d) Define the following terms: Slew Rate (SR), SVRR.

   e) What are differential gain and common mode gain of a differential amplifier?

   f) Find the output voltage of the following circuit:



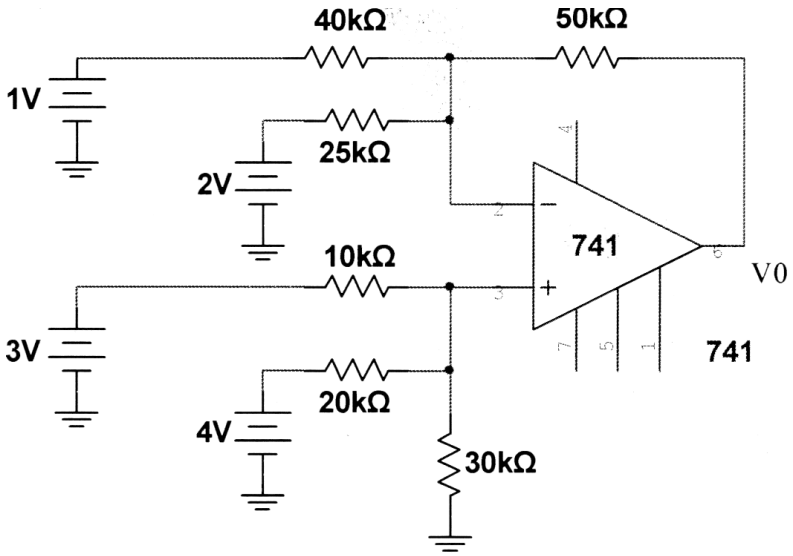
3. Answer any **two** of the following: 5×2=10

a) Draw the functional diagram of IC 555 Timer. Explain with a circuit diagram how it can be connected for monostable operation.

b) Draw the circuit diagram of an inverting Schmitt trigger and explain its operation with the help of hysteresis curve.

c) A differential amplifier has inputs V_1 = 10 mV and V_2 = 9 mV. It has a differential mode gain of 60 dB and a CMRR of 80 dB. Find the percentage error in the output voltage and the error voltage.

d) Find V_0 of the following circuit:



4. Answer any **one** of the following: 6×1=6

a) Draw the circuit of a symmetrical emitter-coupled differential amplifier and derive expression for CMRR. 6

b) Explain the first order low-pass Butterworth filter with a neat circuit. Derive its frequency response. Also design the same filter with higher cut-off frequency of 2 KHz and pass band gain of 5. 4+2=6

c) With the neat circuit diagram, explain the working of Wien bridge oscillator using op-amp. Hence, derive the expression of oscillation frequency and gain of the amplifier. 2+4=6

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