

**B.E. INSTRUMENTATION AND ELECTRONICS ENGINEERING
SECOND YEAR SECOND SEMESTER - 2022**

ANALOG INTEGRATED CIRCUITS

Time : Three hours

Full Marks : 100

ALL MODULES ARE COMPULSORY.

Module – I (10 Marks)

- Q1(a). For the circuit shown in Fig. P1, the switch is initially closed. It is opened at $t = 0s$ and remains open thereafter. Find out the time (in milliseconds) at which the output voltage becomes LOW from HIGH. (5)
- (b) Draw the circuit diagram and explain the operation of an Op-Amp based V-to-I converter for a floating load. (5)

Module – II (10 Marks)

- Q2(a) For the circuit shown in Fig P2(a), find out the voltage at node A. (4)
- (b) Explain the operation of one GIC. How can it be used to synthesize one inductor? (6)

Module – III (60 Marks)

(Answer Q3, Q4 and any TWO from Q5, Q6 and Q7)

- Q3. For the circuit shown in Fig. P3 with ideal switching diodes (OFF when voltage across it is negative and ON when voltage across it is positive) and an ideal OPAMP, what is the difference between the maximum and the minimum values of the capacitor voltage (V_C)? (5)
- Q4. Using analog multipliers and operational amplifiers realize the following function.

$$f(x, y, z) = \frac{2}{3}x^3y^{\frac{1}{3}} + x\sqrt{y/z}$$

Assume that the inputs x , y and z are available as positive voltage sources.

(15)

- Q5. With the help of necessary circuit diagram and waveforms explain the operation of a saw-tooth wave generator. (20)
- Q6. Realize the 5th order Butterworth polynomial in normalized s-domain. Use this polynomial to realize a 5th order Butterworth low-pass filter having 100Hz cutoff frequency and pass band gain 20. Show the final circuit diagram for the filter with all component values. Give the analysis of any assumed circuit block. (5 + 15)
- Q7. With the help of necessary circuit diagram and waveforms explain the operation of a high input impedance precision full wave rectifier. (20)

Module – IV (20 Marks)

(Answer Either Q8 or Q9)

- Q8. With the help of the relevant portion of the internal block diagram of IC-555, explain the operation of a 555-timer based variable duty cycle square wave generator generating a square wave frequency 200 Hz. Draw necessary circuit diagrams and waveforms. (20)
- Q9.(a) "Input offset voltage of an Op-Amp becomes quite significant in an Op-Amp Based astable multivibrator" :- Justify or Deny with proper reasons.
- (b) With the help of necessary circuit diagram and waveform, explain the operation of a 7-bit dual slope ADC. (5 + 15)

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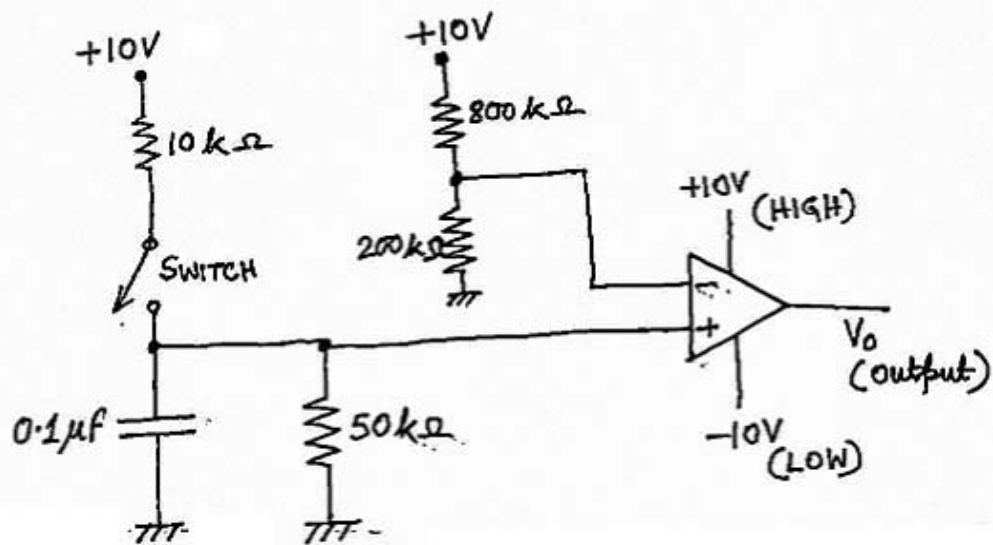


FIG. P1.

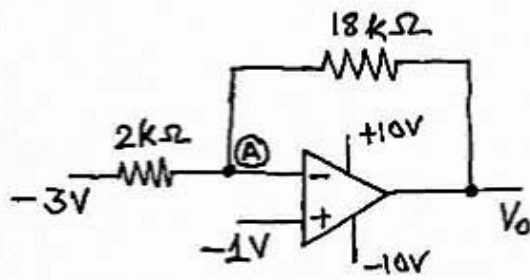


FIG. P2(a)

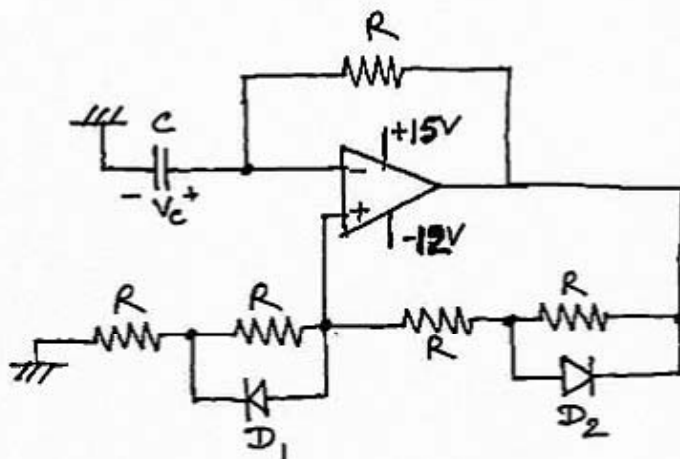


FIG. P3.