

01

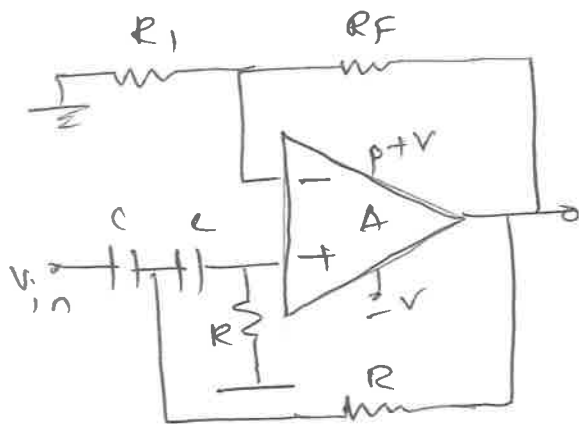
Q.P. 25858

T.E. Biomedical Engineering.

Sem -V (CBSGS)

Analog and Digital Circuit Design (solution)

- Q1 Attempt any **Four** of following. [20]
- MOSFET structure - 01 mark, working - 02 marks, characteristics - 02 marks
 - Block diagram - 02 marks and Explanation of block diagram - 03 marks.
 - Types of analog switches - 05marks
 - Any 4 points with examples - 01 mark each. - 05 marks
 - GIC explanation - 03 marks and Examples - 02 marks
 - PLL block diagram - 02 marks, Explanation of block diagram - 02 marks and list applications - 01 marks.
- Q2 a. Functional Block diagram of IC8038 - 02 mark, Explanation - 03 marks. [05]
- b. A 2nd order Butterworth high pass filter for $f = 1.5$ KHz and also plot its frequency response. [05]
Circuit Diagram - 01 mark, Solution - 02 marks, Plotting frequency response - 02 marks.



Plot freq. response using \rightarrow

$A_F = 1.586 = \text{passband gain}$
for 2nd order Butterworth response

$$A_F = 1 + \frac{R_F}{R_1}$$

$$f = \frac{1}{2\pi RC} = 1.5k$$

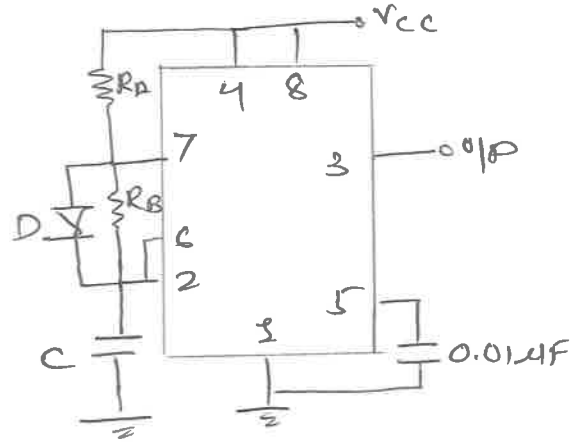
Assume, C then find R

$$\left| \frac{V_o}{V_{in}} \right| = \frac{A_F}{\sqrt{1 + (f_c/f)^4}}$$

- c. Functional Block Diagram - 04 mark, Explanation - 03 marks. [10]
Explanation for pin 2 and 5 - 03 marks
- Q3 a. SCR Diagram - 02 mark, equivalent model - 02 marks, Explanation - 04 marks. [08]
- b. Design an Instrumentation Amplifier using AD620 for gain of 650 and explain its applications. [06]
Circuit Diagram - 02 mark, Design for gain - 02 marks, application - 02 marks.

02

- c. Design a timer for Duty cycle 40% for $T_{on} = 0.8\text{ms}$. Draw corresponding waveforms. [06]
 Circuit Diagram - 01 mark, Solution for R_A, R_B, C - 03 marks.
 Waveforms for V_o (showing T_{on} and T_{off}) and capacitor - 02 marks



As Duty cycle is less than 50%, diode is used to bypass R_B during charging of capacitor i.e. during T_{on} .

$$T = T_{on} + T_{off}$$

$$D = \frac{T_{on} \times 100}{T} = 40$$

$$\text{As } T_{on} = 0.8\text{ms} \Rightarrow T = 2\text{ms}$$

$$T_{off} = 1.2\text{ms}$$

$$T_{on} = 0.693 R_A C$$

$$T_{off} = 0.693 R_B C$$

$$\text{Assume, } C = 0.1\mu\text{F}$$

$$\therefore R_A = 17.32\text{k}\Omega \approx 18\text{k}$$

$$R_B = 11.54\text{k}\Omega \approx 12\text{k}$$

- Q4 a. Comparison between active and passive (3 points) - 02 marks [10]
 KRC filter circuit - 2 marks, Explanation - 02 marks, Derivation of Q - 04 marks
- b. Lock Range - 02 marks, Capture range - 02 marks [05]
 Pull in time - 01 marks.
- c. Missing pulse circuit diagram - 01 mark, working - 02 marks, waveforms - 02 marks [05]

03

Q5 a. Equation for $V_o = 01$ mark and $I_{sc} - 01$ mark and solution - 03 marks

[05]

$$I_{sc} = \frac{V_{sc} n s e}{R_{sc}}$$

$$V_o = V_{N3} = V_{ref} \frac{R_2}{R_1 + R_2}$$

$$R_3 = R_1 \parallel R_2$$

$$V^+ = V_{cc} = V_{in} = 15 \pm 20V$$

b. UJT Relaxation oscillator circuit diagram - 02 mark, working - 02 marks,
Derivation for Frequency - 03 marks

[07]

c. Stepper motor diagram - 03 mark, working - 05 marks.

[08]

Q6. Attempt any **Four** of following:-

[20]

a) Explain FSK using IC 555

Diagram - 02 marks, Explanation - 03 marks

b) Short note on : Switching Mode Power Supply

Diagram - 02 marks, Explanation - 03 marks

c) Short note on : Opto - Isolators and Opto - Couplers

Diagram - 02 marks, Explanation - 03 marks

d) Draw Symbol, structure and characteristics of DIAC and TRIAC.

symbol - 01 mark, structure - 02 marks, Characteristics - 02 marks

e) Draw Frequency response of Butterworth, Chebyshev and Elliptical filters and compare them.

frequency response - 02 marks, Comparison - 03 marks