

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – I • EXAMINATION – WINTER 2012

Subject code: 713101N**Date: 08-01-2013****Subject Name: Medical System Design****Time: 02.30 pm – 05.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Derive the equation of total output offset Voltage e_o Operational Amplifier and describe its significance in Medical System Design. **07**

$$e_o = (1 + (R_2/R_1))e_{os} - I_{off} R_2$$

Where e_{os} = Input offset Voltage, I_{off} = Input Offset Current, R_1 = Input resistor, R_2 = Feedback Resistor

- (b)** Explain Voltage to Frequency converter with neat circuit diagram and derive its equation of output frequency. **07**

- Q.2 (a)** Explain frequency response of the Integrator circuit, also draw and explain circuit of Integrator for Separation of the DC offset from AC signals. **07**

- (b)** Explain SVRR. A type 741 op-amp has Power supply rejection ratio of $150\mu\text{V/V}$ (maximum). It is utilized as a non inverting amplifier with a closed loop gain $A_{cl} = 100$. There is 1.5 V_{pp} (Peak to peak) ripple on the positive supply and a 0.9 V_{pp} (Peak to peak) ripple on the negative supply. Determine the error output voltage. **07**

OR

- (b)** Explain CMRR. A type 741 operational amplifier has the following parameters: $\text{CMRR} = 70\text{ dB}$ (min.) at zero frequency, Corner frequency of the CMRR is $f_{cm} = 200\text{ Hz}$. Determine the CMRR of the amplifier with $R_1 = 1\text{ K}\Omega$, and $R_2 = 100\text{ K}\Omega$ at the operating frequency $f = 1\text{ KHz}$ in dB and mV. Find the output voltage for the input voltage $e_s = 2\text{ V}$. **07**

- Q.3 (a)** Explain Voltage controlled Current Source with grounded load with necessary derivation and describe its significance in design with example. **07**

- (b)** Explain Frequency to Voltage Converter. **07**

OR

- Q.3 (a)** Explain Auto Zero amplifier with circuit diagram, describe its significance in design. **07**

- (b)** Design 4th order Butter worth high pass filter using the Sallen-key configuration. The filter must meet the following specifications: Gain of the filter $A_{hpf} = 1$ and 3 dB cut off frequency $f_c = 668\text{ Hz}$. Consider coefficient $a_1 = 0.76536686$ and $a_2 = 1.84775907$ **07**

- Q.4 (a)** Explain Sample and Hold circuit with feedback and also discuss about maximum allowable frequency. **07**

- (b)** Design using Analog multiplexer Software programmable Gain Amplifier with gain of 1, 2, 5, 10, 20, 50, 100 and 200. **07**

OR

- Q.4** (a) Explain 3 bit Flash type Analog to Digital Converter with its merits and demerits. **07**
(b) Explain Dual slope Analog to Digital Converter and also explain bipolar operation of the Dual slope ADC. **07**

- Q.5** (a) Explain 5 bit Anti logarithmic type Digital to Analog converter. **07**
(b) Explain 4 bit Voltage segment Digital to Analog converter. **07**

OR

- Q.5** (a) Explain Pipe line Analog to Digital converter. **07**
(b) Derive the equation for Instrumentation Amplifier; discuss its significance with example. **07**
