INTERNATIONAL CENTRE FOR APPLIED SCIENCES
MAHE, MANIPAL
B.Sc. (Applied Sciences) in Engg.
End – Semester Theory Examinations – May 2021
IV SEMESTER- IC SYSTEMS (IEC 241)
(BRANCH: E & E)

Time: 3 Hours   **Date: 12 May 2021**   **Max. Marks: 50**

✓ **Answer ALL Questions.**
✓ **Missing data, if any, may be suitably assume.**

1A. Draw the circuit of an emitter coupled differential amplifier. Perform the AC analysis of the circuit and hence obtain the expression for differential gain of the amplifier. **(5)**

1B. Define (i) Input bias current, (ii) Input offset current and (iii) Input offset voltage. In a certain non-inverting amplifier circuit, R_F=10 kΩ and R_1=1 kΩ. Calculate the maximum output offset voltage due to input offset voltage (V_{ios}) and input bias current (I_B). Assume V_{ios}=10mV and I_B=300ηA. **(5)**

2A. Explain the following with circuit diagram, waveforms, and expressions.
    i)   Full wave precision rectifier using Op-amp.
    ii)   Positive clipper using Op-amp.
    iii) Analog divider. **(5)**

2B. For the circuit shown in figure Q2B below, (a) Obtain the expression for output voltage in-terms of V_1 and V_2. (b) Calculate the output voltage V_o, if V_1=-0.5V and V_2=0.5V. (c) State the function of each amplifier in the circuit. Assume Op-amps with $\pm V_{SAT} = \pm$ 12V.
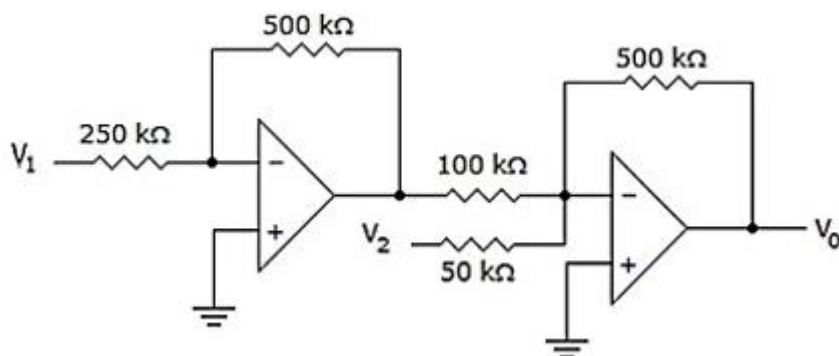

Figure Q2B.

(5)

3A. Describe All-pass filter with the help of necessary circuit, waveforms and expressions. Obtain the expression for phase delay. How do you obtain a positive phase response? Explain. **(5)**

3B. What is PLL? Give the applications of PLL. With the help of block diagram, explain the role and working of each functional unit. Define the terms, (i) Free running (ii) Capture range, (iii) Locking range. **(5)**

4A. Draw the circuit diagram of Op-amp based triangular wave generator. Explain its working principle with neat waveform and necessary derivations. **(5)**

4B. Write the necessary conditions to realize Band Stop Filter (BSF) using Low Pass Filter and High Pass Filter. Design a wide band-stop filter using first order high pass filter and low pass filter having f_H=1000 Hz and f_L = 10 kHz. Assume passband gain of 2 and capacitors are of 0.1μF. **(5)**

5A. Draw the functional diagram of IC555 timer and explain its operation. Configure the timer in astable mode and derive the expression the for the output frequency of oscillation. **(5)**

5B. Draw the circuit diagram of 3-bit R-2R ladder digital to analog converter (DAC) and explain its operation. Convert the following 3-bit words input into equivalent analog output. i) 100 ii) 011. Assume full scale output of 10V. **(5)**

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