Ministry of Higher Education and Scientific Research Faculty of Engineering Kafrelsheikh University	كلية الهندسة	وزارة التعليم العالي والبحث العلمي كلية الهندسة جامعة كفر الشيخ
First-term Examination of Academic Year 2019/2020		
Department: Electrical Engineering	**Year: Third year**	**Total Marks: 85**
Course Title: Electronic Measurements and Testing (1)	**Course Code: ECE 3006**	**Term: First Term**
Date: Jan. 15 - 2020	**Number of questions: 4**	**Allowed Time:** 180 Minutes

Answer the following questions

Illustrate your answers with sketches when necessary

Question 1 **(20 Marks)**

I. Given figure 1, drive and sketch the voltage transfer function of that passive RC filter. (7 Marks)

II. Given figure 1, design that filter with cut-off frequencies of 160 Hz and 8 kHz. The load for this circuit is 1 MΩ. For good design purpose, filter output resistor should be one tenth of load resistor and its input resistor should be one tenth of its output resistor. (6 Marks)

III. We have an amplifier that amplifies a 1 kHz signal from a detector. The load for this amplifier can be modeled as a 50 kΩ resistor. The amplifier output has a large amount of 60 Hz noise. We need to reduce the amplitude of noise by a factor of 10. Design a first-order passive filter which can be placed between the amplifier and the load and does the job. (7 Marks)

Question 2 **(25 Marks)**

I. Drive an expression for the output voltage difference v_{D2D1}, Fig.2, as a function of the input voltage difference v_{G2G1}. (5 Marks)

II. Modify the MOS differential-pair configuration and prove that it can be used as analog multiplier with temperature dependent term. (10 Marks)

III. Explain and prove how you can eliminate the temperature dependent term. (10 Marks)

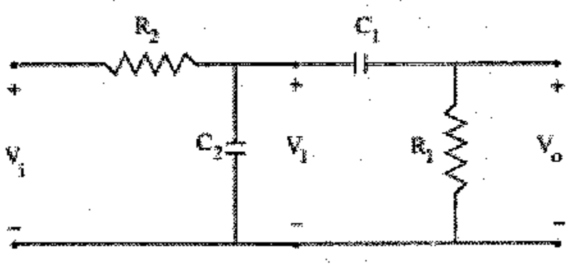

Figure 1

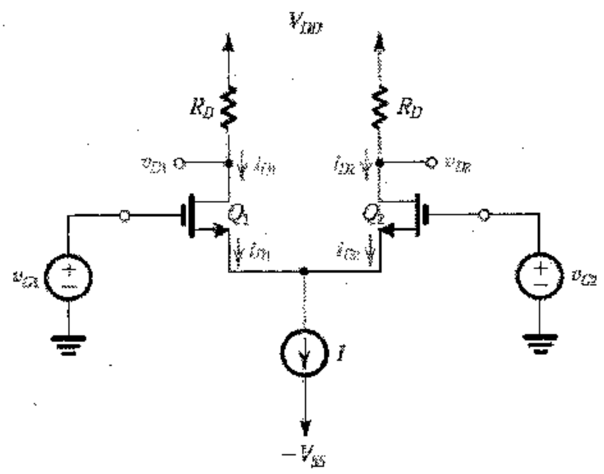

Figure 2

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Question 3 **(20 Marks)**

Suppose that the modulating signal $m(t)$ is a sinusoid of the form $m(t) = a\ cos\ \omega_m t$ with the carrier signal $c(t) = A\ cos\ (\omega_c t + \emptyset_c)$ $\omega_m \ll \omega_c$

I. Determine and sketch the DSB-SC AM signal and its upper and lower sidebands in both time and frequency domain. (5 Marks)

II. determine the power-spectral density of the modulated signal, the power in the modulated signal, and the power in each of the sidebands. (5 Marks)

III. Given Figure 3 and same modulating signal, Drive an expression of output signal in time and frequency domain (5 Marks)

IV. State the advantages and disadvantages of figure 3 scheme as compared to DSB-SC AM scheme (5 Marks)

Question 4 **(20 Marks)**

I. Given figure 4, drive the transfer function of the feedback network, closed loop gain of the opamp, and oscillation frequency. (10 Marks)

II. Given Figure 4, design the circuit to generate 1 KHz. Assume any necessary resistors values. (10 Marks)

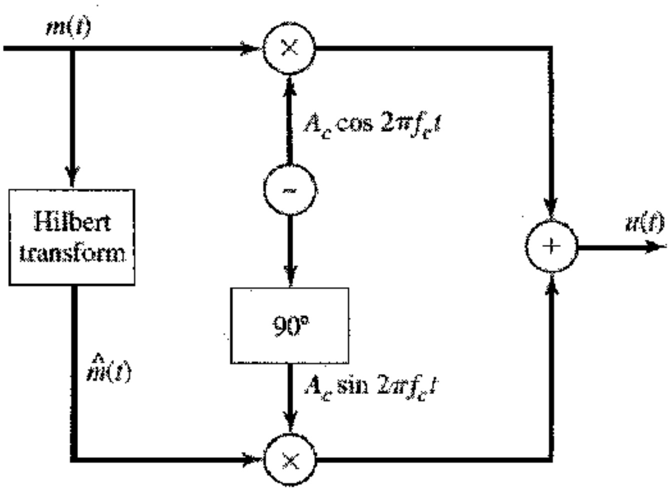

Figure 3

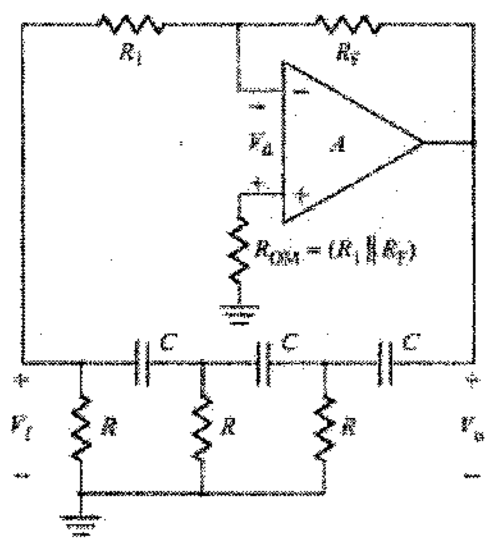

Figure 4

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