**An-Najah National University**

**جامعة النجاح الوطنية**

**كلية الهندسة**

**قسم الهندسة الكهربائية**

**Faculty of Engineering**

**Department of Electrical Engineering**

**Electrical Engineering Department**

**Communications and signal processing (69371)**

**First exam**

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| **Instructor Name: Falah Mohammed** | **Student name:** |
| **Academic Year:2011/2012** | **Registration number:** |
| **Semester: spring** | **Serial number:** |
| **Credit Hours: 3** | **Section** |
| **Date: Monday, March 12, 2012** | **Total exam marks 20** |
| **Exam Duration:60 minutes** | **Exam weight 20** |

*Exam Notes:*

1. Close Books & Notes.
2. Read each problem carefully before attempting to solve it.
3. Write all work on this exam paper.

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| **Question** | **Marks** | **ILO’s** | **ILO’s %** | **Question grade** | **Required time** |
| **Q1** | **10** | **1** | **100%** |  | 25 |
| **Q2** | **7** | **2** | **100%** |  | 25 |
| **Q3** | **3** | **3** | **100%** |  | 10 |
| **Student grade** |  |  |

Good Luck

1. (ILOs 1) 10 pts

An AM transmitter is modulated with an audio testing signal given by $f\left(t\right)=0.2sin\left(1000πt\right)+0.5cos⁡\left(2000πt\right)$, and $A\_{c}=2$. Assume that the AM signal is fed into 50 Ω load.

1. What is the modulation index of the modulated signal
2. What is the bandwidth required for the transmission of this AM modulated signal
3. Evaluate and sketch the line spectrum of the AM waveform
4. Compute the efficiency of the AM system under these conditions
5. (ILOs 2) 7 pts

Design an AM modulator to modulate an analog signal defined by $f\left(t\right)=\frac{1}{3}cos2π120t$ is using square law modulator which is shown in Figure 1. Assume that the carrier frequency is 10 kHz. Assume also the input output characteristics of the modulator are given by $v\_{o}\left(t\right)=a\_{1}v\_{i}\left(t\right)+a\_{2}v\_{i}^{2}\left(t\right)$. Where *a1* and *a2* are constants, $v\_{i}(t)$ is the input, and $v\_{o}\left(t\right)$ is the output to the nonlinear device.

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Figure

1. In your design give the center frequency and the bandwidth of the band pass filter such that the system will produce a standard AM signal
2. Determine the values of *a1* and *a2* if the carrier amplitude is $A\_{c}=10$ and the resulting modulation index is $m=0.10$
3. (ILOs 3) 3 pts

A super-heterodyne receiver uses an IF frequency of 455 kHz. The receiver is tuned to a transmitter having a carrier frequency of 1120 kHz. Give two permissible frequencies of the local oscillator and the image frequency for each.