**An-Najah National University**

**جامعة النجاح الوطنية**

**كلية الهندسة**

**قسم الهندسة الكهربائية**

**Faculty of Engineering**

**Department of Electrical Engineering**

**Electrical Engineering Department**

**Principle of communications (69322)**

**Second exam**

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| **Instructor Name: Falah Mohammed** | **Student name:** |
| **Academic Year:2014/2015** | **Registration number:** |
| **Semester: spring** | **Serial number:** |
| **Credit Hours: 3** | **Section** |
| **Date: Sunday, November 2, 2014** | **Total exam marks 20** |
| **Exam Duration:50 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** |  |  |  | 15 minutes |
| **Q2** | **10** |  |  |  | 15 minutes |
| **Q3** | **5** |  |  |  | 20 minutes |
| **Student grade** |  | 50 minutes |

Good Luck

1. 10 pts

An FM transmitter has a block diagram as shown in Fig. 1 The audio frequency response is flat over the 20 Hz to 15 kHz audio band. The FM output signal is to have a carrier frequency of 103.7 MHz and a peak frequency deviation of 75 kHz.

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Figure 1

1. Find the bandwidth and center frequency required for the bandpass filter.
2. Calculate the local oscillator frequency $f\_{0}$
3. What is the required peak frequency deviation capability of the FM exciter (narrow band FM modulator)
4. Explain how can the FM signal be modulated

1. 10 pts

The sinusoidal signal $f\left(t\right)=\cos(\left(2π×10^{3}t\right))$ is applied to the input of a FM system. The corresponding modulated signal is given by $φ\left(t\right)=100\cos(\left(2π×10^{7}t+4sin2000πt\right))$ across a 50 Ω load

1. What is the peak frequency deviation from the carrier
2. What is the total average power?
3. What percentage the average power is at 10.002 MHz?
4. What is the approximate bandwidth, using Carson’s rule?
5. 5 pts

A certain three channel PAM is shown in $f\_{1}\left(t\right)$ is band-limited to 7 kHz and $f\_{2}\left(t\right)$ and $f\_{3}(t)$ are each band limited to 3 kHz.

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Figure 1

1. Determine the value of the commutator clock rate such that all three signals can be reconstructed at the receiver without distortion under ideal conditions
2. If the commentator switch is followed by a LPF, what is the required band width of the LPF filter bandwidth of the transmitted signal
3. If each sample out of the commutator is quantized into 8-bits what is the resulting bit rate