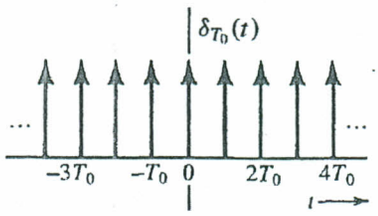
Mansoura University	**January 2013**	**Communication Systems**
Faculty of Engineering	**Time: 3 hours**	**Final Term Exam**
Elect. Eng. Department	**Marks: 110**	**Dr. S. Marzouk**

Question#1 (22 marks):

(a) Why is modulation necessary in long distance communication? [6]
(b) Describe the fundamental parameters that control the rate and quality of information transmission. [5]
(c) Describe the different types of transmission modes. [5]
(d) Draw a schematic diagram to illustrate the basic elements of a communication system to transmit and receive audio signals. [6]

Question#2 (22 marks):

(a) Find the compact Fourier series of the periodic impulse train δ_{T_0} shown in the figure. [8]



(b) Evaluate the effect of a small frequency error in the local oscillator on synchronous DSB demodulation. [6]
(c) Explain one method of detecting DSB signal. [8]

Question#3 (24 marks):

(a) Describe the operation of a rectifier demodulator. [8]
(b) Explain the function and theory of operation of the mixer. [6]
(c) For a baseband signal $m(t) = \cos \omega_m t$,
1. Sketch the time-domain modulated signal $\varphi_{DSB}(t)$. [3]
2. Sketch the Fourier transform of the modulated signal. [4]
3. Find the bandwidth of both signals $m(t)$ and $\varphi_{DSB}(t)$. [3]

Question#4 (20 marks):

(a) Suppose you have an FM modulator. Using a block diagram, explain how a PM signal can be generated using this FM modulator. [5]
(b) Suppose you have a PM modulator. Using a block diagram, explain how an FM signal can be generated using this PM modulator. [5]
(c) Give two main applications of a Phase Lock Loop (PLL) circuit in communication systems. [4]
(d) Describe how to generate a narrow band FM wave (NBFM) and an NBPM wave. [6]

Question#5 (22 marks):

(a) A carrier wave of frequency 10 MHz is frequency modulated with a sinusoidal signal of frequency 5 MHz, resulting in a maximum frequency deviation of 1 MHz.
1. Find the bandwidth of the modulated signal. [4]
2. If the amplitude of the modulating sinusoid is doubled, find the bandwidth of the modulated signal. [4]
3. If the frequency of the modulating signal is doubled, find the bandwidth of the new modulated signal. [4]

(b) Determine the Nyquist rate and the Nyquist sampling interval for the signals: [10]
1. $\text{sinc}\,(100\pi t)$ 2. $\text{sinc}^2\,(100\pi t)$