

LAHORE UNIVERSITY OF MANAGEMENT SCIENCES
Department of Electrical Engineering

EE310 Signals and Systems
Quiz 6

Name: _____

Campus ID: _____

Total Marks: 10

Time Duration: 20 minutes

Question 1 (5 marks)

(2+2+1)

Let $m(t)$ be a real message signal whose Fourier transform $M(j\omega)$ is bandlimited to $|\omega| \leq W$. The DSB-SC modulated signal is

$$s(t) = m(t) \cos(\omega_c t + \theta), \quad \omega_c \gg W,$$

where θ is an unknown constant phase offset.

1. Derive $S(j\omega)$ in terms of $M(j\omega)$, ω_c , and θ .
2. A coherent demodulator multiplies $s(t)$ by the phase-mismatched local carrier $2 \cos(\omega_c t)$ and passes the result through an ideal low-pass filter with cutoff ω_c and unit gain. Show that the recovered signal is $m(t) \cos \theta$, and identify all values of $\theta \in [0, 2\pi)$ for which the demodulator *completely suppresses* the output.

Question 2 (5 marks)

(1+1+2+1) Define the signal

$$p(t) = \frac{\sin(3t)}{\pi t} \cdot \frac{\sin(2t)}{\pi t}$$

Using the convolution theorem, find and sketch $P(j\omega)$.