



### Answer Only Five Questions

**Q1: (a)** Classify the signal  $x(t) = 4 \cos \omega t$  as a power signal or energy signal and find its power or energy.

(6 marks)

**(b)** Determine the z-transform and the Region of Convergence for the signal

$$x(m) = \begin{cases} 0 & m \geq 0 \\ \alpha^m & m < 0 \end{cases}$$

Then only use time shift property to determine the z-transform for a time-delayed version of same signal

$$x(m) = \begin{cases} 0 & m \geq 0 \\ \alpha^m & m < -k \end{cases}$$

(6 marks)

**Q2: (a)** Determine and sketch the output  $y(t)$  of a LTI system with the impulse response  $h(t)$  and the input signal  $x(t)$  are given in Figure (1).

**Note:** Shift the impulse response  $h(t)$ .

(8 marks)

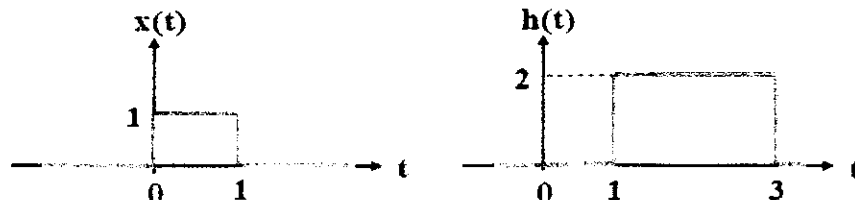


Figure (1)

**(b)** Consider the analog signal  $x(t) = 3 \sin 100\pi t$ .

1. Determine the minimum sampling rate required to avoid aliasing.

2. Suppose that the signal is sampled at the rate  $F_s = 220 \text{ Hz}$ , what the discrete signal  $x[n]$  obtained after sampling.

(4 marks)

**Q3: (a)** From table and by using one of properties, find the Fourier transform of the

following signal  $f(t) = \cos(at - \frac{\pi}{3})$ .

(6 marks)

**(b)** By matrix method, compute IDFT for the sequences  $X(k) = \{4, 1 - j, -2, 1 + j\}$

(6 marks)

**Q4: (a)** An antenna has a filed pattern given by  $E(\theta) = \cos \theta \cdot \cos 2\theta$  for  $0^\circ \leq \theta \leq 90^\circ$  find:

1. The half-power beamwidth (HPBW).
2. The beamwidth between first nulls (FNBW).

(6 marks)

**(b)** An SSB transmitter using the filter method operates at a frequency of 4.2 MHz.

The voice frequency range is 300 to 3400 Hz.

1. Calculate the upper and lower sideband ranges.
2. What should be the approximate center frequency of a bandpass filter to select the lower side band?

(6 marks)

**Q5: (a)** A loss less transmission line is 80 cm long and operates at a frequency of 600 MHz. The line parameters are  $L=0.25 \mu\text{H/m}$  and  $C=100\text{pF/m}$  find:

1. The characteristic impedance.
2. The phase constant.
3. The velocity on the line.

(6 marks)

**(b)** The equation of an angle – modulated voltage  $\phi(t) = 10\cos(10^8 t + 3 \sin 10^4 t)$

1. What form of angle modulation is this?
2. Calculate the carrier and modulating frequencies.
3. Calculate the modulation index, deviation and the power dissipated in a  $100\Omega$  resistor.

(6 marks)

**Q6: (a)** A communications channel with a bandwidth of 4 kHz has a signal power to noise ratio of 7. The bandwidth is reduced by 25 %. How much should the signal power be increased to maintain the same channel capacity?

(8 marks)

**(b)** The waveform shown in Figure (2) is the PAM for the analog signal, draw the analog signal PWM and the PPM for this signal.

(4 marks)

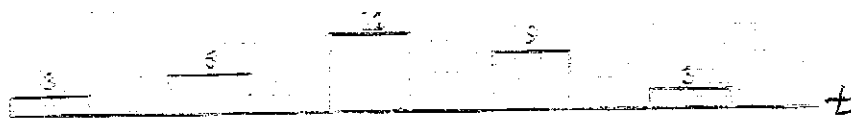


Figure (2)

*Good Luck*