Question Paper

Exam Date & Time: 28-Apr-2018 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
END SEMESTER THEORY EXAMINATION - APRIL 2018
IV SEMESTER B. S. (ENGG)
Date: 28.04.2018
Time: 9.30 A. M. TO 12.30 P.M.
Signal Analysis and Telemetry [BM 241]

Marks: 100 **Duration: 180 mins.**

Answer 5 out of 8 questions.

Missing data, if any, may be suitably assumed

1) (6)

A) Determine whether the following signals are energy signals, power signals, or neither.

a) $x(n) = (-0.5)^n u(n)$ b) $x(n) = u(n) - u(n-5)$ c) $x(n) = e^{j\left(2n+\frac{\pi}{4}\right)}$

B) (8)

Explain with an example the following properties of systems.
a) Causality b) Invertibility c) Static and Dynamic d) Shift invariance

C) (6)

Define the following signals mathematically and represent graphically.
(a) Impulse (b) Step (c) Ramp (d) Sinusoidal

2) (8)

A) Find the discrete-time Fourier coefficients for $x(n) = \sin\left(\frac{\pi}{3}\right)n + \cos\left(\frac{\pi}{6}\right)n$

B) (6)

Determine the inverse discrete time Fourier transform of

$$X(e^{j\omega}) = 2\sin 2\omega, -\pi < \omega < \pi$$

C) (6)

Determine the Fourier transform of the signal $x(n) = 6(2)^n u(n)$ Find the magnitude and phase angle.

3) (8)

A) Consider a causal and stable linear shift invariant system whose input and output are related through a second order difference equation $y(n) - \frac{1}{6}y(n-1) - \frac{1}{6}y(n-2) = x(n)$ Determine the frequency response and the impulse response of the system.

B) (6)

Given $x(n) \xleftrightarrow{z} X(z) = \frac{z}{z^2+4}$ with ROC: $|z| < 2$ Using the Z-transform properties, determine the Z-transform of following signals.

(a) $y_1(n) = 2^n x(n)$ (b) $y_2(n) = nx(n)$

C) (6)

Describe the following properties of discrete time fourier transform with proof.
a) Linearity b) Time shift c) Differentiation in frequency

4) (8)

A) Using the partial fraction method, determine the inverse z- transform of
$X(z) = \frac{4 - 3z^{-1} + 3z^{-2}}{(z+2)(z-3)^2}$; $|z| > 3$

B) (6)

Find the z-transform of the following. Find ROC and plot.

(a) $x(n)=7\left(\frac{1}{3}\right)^n u(n)-6\left(\frac{1}{2}\right)^n u(n)$ (b) $x(n)=-\alpha^n u(-n-1)$

C) (6)

Explain the following terms: Give one example for each.

a) Continuous and discrete signals
b) Deterministic and random signals
c) Power and energy signals

5) (6)

A) A 100 MHz carrier frequency modulated by a sinusoidal signal of frequency 200 KHz, so that the maximum frequency deviation is 1.5 MHz

i) Determine the bandwidth of FM carrier.
ii) Find the bandwidth if the modulating signal amplitude is doubled.
iii) What is the bandwidth, if frequency of modulating signal is also doubled?

B) (8)

Describe the detection of amplitude modulated wave using the square law detector.

C) (6)

How do you generate amplitude modulated double side band full carrier wave? Explain any one method.

6) (6)

A) In a FM broadcasting system, the modulating signal frequency is 20 KHz and frequency deviation is 80 KHz. Determine the appropriate transmission bandwidth. What is the transmission bandwidth if the modulating signal amplitude is attenuated by a factor 2?

B) (8)

Define a telemetry system. With a block schematic explain the telemetry system.

C) (6)

Draw the Frequency modulated signal and determine the expression for modulation index.

7) (8)

Explain the generation and detection of PAM signal.

A)

B) (6)

Explain the following terms:
(a) Modulation index (b) Narrow band FM

C) (6)

How do you generate the frequency modulated signal based on parameter variation? Explain

8) (8)

Explain the generation and detection of pulse width modulation signals.

A)

B) (6)

Describe the single channel telemetry system for the transmission of ECG signal.

C) (6)

Discuss at least three applications of Bio-telemetry.

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