

DEE-303

## Diploma in Computer Engineering, Semester III, Examination, 2014-15

## Signals and Systems

Paper No. DEE-303

Time : Three Hours

Maximum Marks : 60

(Write your Roll No. on the top immediately on receipt of this question paper.)

Note : Attempt any two parts from each question. Assume missing data suitably, if any.

1. Define even and odd signals. Determine :

(a) The odd and even components of sequence

$$x[n] = \begin{Bmatrix} 1, & 1, & 0.5 \\ & \uparrow & \end{Bmatrix}$$

(6 Marks)

(b) What are periodic and aperiodic signals? Find whether the following signal  $x(t)$  is periodic or not.

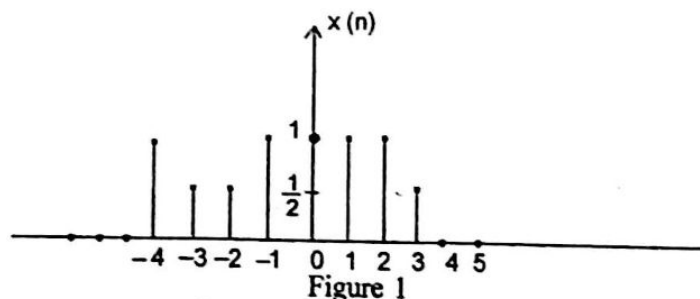
$$x(t) = 3 \cdot \cos\left(17\pi t + \frac{\pi}{3}\right) + 2 \cdot \sin\left(19\pi t - \frac{\pi}{3}\right)$$

(6 Marks)

(c) A discrete time signal is shown in figure 1, sketch and label each of the following :

(i)  $x(n-4)$ (ii)  $x(3n)$ (iii)  $x(n-2) \cdot u(n)$ 

(6 Marks)

2. (a) What are Linear and Non-linear systems? Find whether the following system  $y(n)$  is linear or not.

$$y(n] = 3x(n) + \frac{1}{x(n-1)}$$

(6 Marks)  
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(b) Find whether the following system is :

- (i) Static/dynamic
- (ii) Causal/Non-causal
- (iii) Time variant/invariant

$$y(t) = A.x(t) + B$$

(6 Marks)

(c) Write short notes on the following systems :

- (i) Continuous and Discrete time systems
- (ii) Time-invariant and variant systems
- (iii) Causal and non-causal systems

(6 Marks)

3. (a) What do you mean by Frequency Modulation ? Derive the formula for the instantaneous value of FM voltage and define its modulation index.  $= \frac{\Delta \omega}{\omega_m}$  (6 Marks)

(b) What is Multiplexing ? Why is it needed ? Briefly describe the two basic forms of multiplexing. (6 Marks)

(c) The antenna current of an AM broadcast transmitter, modulated to a depth of 40 percent by an audio sine wave, is 14 A. It increases to 16 A as a result of simultaneous modulation by another audio sine wave. What is the modulation index due to this second wave ?

$$m_1 = 0.4, m_2 = 0.92 \quad (6 \text{ Marks})$$

4. (a) State Sampling Theorem. Determine the Nyquist rate and Nyquist interval corresponding to each of the following signals :

(i)  $x_1(t) = 3 \cdot \cos(50\pi t) + 5 \sin(300\pi t)$

(ii)  $x_2(t) = 1 + 2 \cdot \cos(20\pi t) + 3 \cos(30\pi t)$

(iii)  $x_3(t) = \cos(150\pi t) \cdot \sin(100\pi t)$

(iv)  $x_4(t) = \cos^3(200\pi t)$

$$\omega_s \geq 2\omega_m$$
$$T_s = \frac{1}{f_s}$$

(6 Marks)

(b) What is the effect of under sampling ? Describe in brief. (6 Marks)

(c) Describe the zero-order hold sampling technique in brief. (6 Marks)

5. (a) Differentiate between open loop and closed loop control systems. Also describe their input-output configurations. (6 Marks)

(b) State Routh Stability Criterion and determine the stability of a system having characteristic equation :

$$F(s) = s^6 + 4s^5 + 12s^4 + 16s^3 + 41s^2 + 36s + 72$$

(6 Marks)

(c) Draw the root locus plot for a feedback system with the characteristic equation

$$1 + \frac{K}{s(s+2)(s+4)} = 0; K \geq 0$$

(6 Marks)

(2)

Parabola

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$$C = -2$$

$$m = \sqrt{m_1^2 + m_2^2}$$