Roll No.:.....

National Institute of Technology Delhi

Name of the Examination: B.Tech.

Branch: ECE,CSE,EEE
Course Title: Signals and Systems
Time: 3 Hours
Note: Answer all questions in short.

Semester: 3^{rd}
Course Code: ECB 204
Maximum Marks: 50

Section - A: Each question is of 2 mark, attempt all questions

Q.1 (a) Check $x(t) = t^3$ is even or odd signal.

Q.1 (b) Check the given signal $x(t) = cos(0.5t) + sin(\pi t)$ is periodic or non-periodic. Find the period of signal if it is periodic.

Q.1 (c) Check the given signal $x(t) = e^{-8t}u(t)$ is energy or power or neither of both.

Q.1 (d) Check whether the system having impulse response $h(t)$ is BIBO stable or not?

$$h(t) = t + 2$$

Q.1 (e) Find the convolution of the given discrete time signals

$$x[n] = [\,2 \;\underset{\uparrow}{4}\; 2\,]$$

and

$$h[n] = [\,3 \;\underset{\uparrow}{3}\; 3\,]$$

Section - B: Attempt any four questions

Q. 2. A continuous time signal $x(t)$ is shown in *Fig.*1. Sketch and label carefully the following signal $x(4t + 20)$.

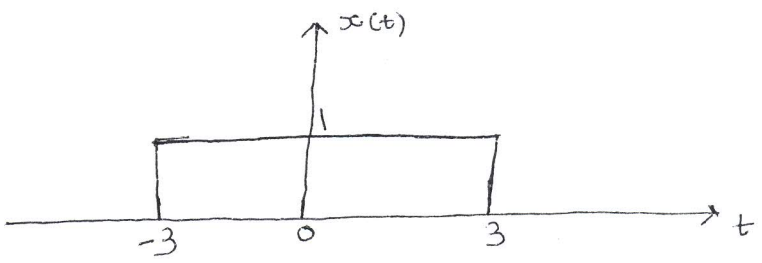

*Fig.*1

Q.3. Let $x(t)$ be a signal with $x(t) = 0$ for $t < 10$. Determine the values of t for which the even part of signal $y(t)$ is guaranteed to be zero.

$$y(t) = x(3 - 5t) + x(\frac{t}{3} - 5)$$

Q.4. Compute the convolution $y(t) = x(t) * h(t)$, where

$$h(t) = u(t) - u(t - 2)$$

and

$$x(t) = e^{-2t}u(t)$$

Q. 5. Let

$$x[n] = -1^n u[n] + \alpha^n u[-n - n_0]$$

Determine the constraints on the complex number α and integer n_0, given that the ROC of X(z) is $1 < |z| < 2$.

Q. 6. Find the trigonometric Fourier series of a periodic signal $x(t)$ defined by

$$x(t) = t^2, \quad for \quad -\pi < t < \pi \quad and \quad x(t + 2\pi) = x(t).$$

Section - C: Attempt any two questions

Q.7. Let $x_1(t)$ be a continuous time periodic signal with fundamental frequency w_1 and Fourier series coefficients a_k, Given that

$$x_2(t) = x_1(t + 2) + x_1(t + 4)$$

How is the fundamental frequency w_2 of $x_2(t)$ related to w_1 ? Also find Fourier series coefficients b_k of $x_2(t)$ as a function of coefficients a_k.

Q.8. The system function of a causal LTI system is

$$H(s) = \frac{s + 1}{s^2 + s + 2}$$

Determine and sketch the response y(t) when the input is

$$x(t) = e^{-|t|} \quad for \quad 0 \leq t \leq 2.$$

Q.9. For the given following second order differential equation for causal and stable LTI systems, determine whether the corresponding impulse response is under-damped, over-damped, critically-damped or oscillatory.

$$\frac{d^2y}{dt^2} + 20\frac{dy}{dt} + y(t) = x(t)$$

End of Question Paper