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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B. Tech Electronics (BCT and IOT)	**Semester – III**
Subject (Course): Signal and System	**Max. Marks : 100**
Course Code :ELEG 229	**Duration : 3 Hrs**
No. of page/s:	

Note- ALL questions are compulsory.

Section A (4 x 5= 20)

Q1-: What do you mean by system. Explain in detail all types of system?

Q2: What do you understand by region of convergence of laplace transform?

Q3: Differentiate between causal and noncausal system with some example?

Q4- Find the Convolution of the following signals

$$x_1(t) = e^{-2t}u(t); \; x_2(t) = e^{-4t}u(t);$$

Section B (10x 4= 40)

Q5- Determine the Laplace transform of an anticausal signal.

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

Q6-Asystem has H(w)= $\dfrac{jw+1}{(jw+2)(jw+3)}$ .Find the following using Fourier transform

(a)   Its impulse response
(b)   Its response to the input $e^{-2t}u(t)$

Q7- Find the Fourier Transform of the anticausal sequence
$$x(n) = a^{-n}u(-n-1), |a|<1$$

Q8- The system that follow have input x(t) or x(n) and output y(t) or y(n).For each system determine whether it is
(i)   Memory less (ii)Stable (iii) Causal(iv)Linear

$$y(t) = \begin{cases} 0, x(t) < 0 \\ x(t) + x(t-2), t \geq 0 \end{cases}$$

Section C (2 x 20 = 40)   Attempt any two

Q 9- Design a discrete time LTI system with the property that if the input is

$$x(n) = \left(\frac{1}{2}\right)^n u(n) - \frac{1}{4}\left(\frac{1}{2}\right)^{n-1} u(n-1)$$

Then the output is

$$y(n) = \left(\frac{1}{3}\right)^n u(n)$$

(a) Find the impulse response and frequency response of a discrete time LTI system.
(b) Find the difference equation relating x(n) and y(n) that characterizes the system.

Q10 - $X(s) = \dfrac{1}{s^2(s+2)}$ A causal discrete time LTI system is described by

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n)$$

Where x(n) and y(n) are the input and output of the system, respectively
(a) Determine the system function H(z) for a causal system function.
(b) Find the impulse response h(n) of the system.
(c) Find the step response of the system.

Q11-Determine the unilateral Z- Transform of each of the following sequences.

(a) $x(n) = \left(\frac{1}{4}\right)^n u(3-n)$

(b) $x(n) = 2^n u(-n) + \left(\frac{1}{4}\right)^n u(n-1)$

Set 2

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<u>Section A (4 x 5= 20)</u>

Q1-: Differentiate between lumped and distributed parameter system?

Q2- Find the fourier series for the periodic signal x(t)=t for $0 \leq t \leq 1$ so that it repeats every 1 seconds?

Q3: What do you understand by frequency Spectrum of a signal?

Q4- Find the Fourier Transform of the following periodic signal

$x(n) = \sin(w_0 n)$ with $w_0 = \dfrac{2\pi}{5}$

<u>Section B (4 x 10= 40)</u>

Q5- Determine the Laplace transform and the associated ROC for each of the following function of time.

(a) $g(t) = te^{-2|t|}$

(b) $x(t) = \delta(3t) + u(3t)$

Q6: Determine and sketch the magnitude and phase response of the LTI causal system described by the differential equations

$$\frac{dy(t)}{dt} + y(t) = \frac{dx(t)}{dt} - x(t)$$

Q 7-The output y(t) of a causal LTI system is related to the input x(t) by the equation

$$\frac{dy(t)}{dt} + 10y(t) = \int_{-\infty}^{\infty} x(\tau)z(t-\tau)d\tau - x(t)$$

where $z(t) = e^{-t}u(t) + 3\delta(t)$

(a) Find the frequency response H(w) of this system
(b) Determine the impulse response of the system.

Q8- The system is having input x(t) or x(n) and output y(t) or y(n).For given system $y(t) = x^2$ determine whether it is
   (i)   Memory less
   (ii)   Stable
   (iii)   Causal
   (iv)   Linear
   (v)   Time invariant

Section C (2 x 20 = 40)   Attempt any Two

Q9- The system function of a causal LTI system is

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

Determine the response Y(t) when the input $x(t) = e^{-|t|}$

(a) Find the inverse transform of the functions

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

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

Q10- A causal discrete time LTI system is described by

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n)$$

Where x(n) and y(n) are the input and output of the system, respectively
(d) Determine the system function H(z) for a causal system function.
(e) Find the impulse response h(n) of the system.
(f) Find the step response of the system.

Q11- An LTI system is characterized by the system function

$$H(z) = \frac{3 - 4z^{-1}}{1 - 3.5z^{-1} + 1.5z^{-2}}$$

Specify the ROC of H(z) and determine h (n) for the following conditions:

(a) The system is causal and unstable
(b) The system is noncausal and stable
(c) The system is anticausal and unstable