Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2022

Course: Signals and Systems **Semester: III**
Program: B. Tech Mechatronics/ B.Tech ECE **Time : 03 hrs.**
Course Code: ECEG 2010 **Max. Marks: 100**

Instructions:

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Find whether the following systems are (1) Static and Dynamic (2)Linear and Non Linear (3) Causal and Non causal (4) Time invariant and time Variant (a) Y(t) = | x(t)|	4	CO1
Q 2	Determine whether the following signals are power or energy signals or neither. (a) x(t)= $e^{-5t}u(t)$	4	CO1
Q 3	Consider a continuous time system with input x(t) and output y(t) related by y(t) =x sin(t) (a) Is this system Causal? (b) Is this system linear ?	4	CO1
Q 4	What is the relation between laplace transform and fourier transform?	4	CO3
Q 5	What is the condition for Z Transform the exist?	4	CO4

SECTION B
(4Qx10M= 40 Marks)

Q 6	Use the unilateral Laplace transform to determine the output of a system represented by the differential equation $\frac{d^2y(t)}{dt^2}+5\frac{dy(t)}{dt}+6y(t)=\frac{dx(t)}{dt}+6x(t)$	10	CO3

	In response to the input x(t) =u(t). Assume to the initial condition on the system are $y(0^-) = 1$ and $\dot{y}(0^-)=2$. Identify the zero state response of the system and the zero input response.		
Q 7	Find the Fourier Transform of the causal sequence $x(n) = a^n u(n), \mid a \mid < 1$	**10**	**CO2**
Q 8	Determine the Laplace transform and the associated ROC for each of the following function of time. (a) $g(t) = te^{-2\|t\|}$ (b) $x(t) = \delta(3t) + u(3t)$	**10**	**CO2**
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. **OR** Determine the z transform of the anticausal signal $x(n) = -a^n u(-n-1)$ and depict the ROC and the locations of poles and zeros in the z plane.	**10** **10**	**CO3**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	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	**20**	**CO3**
Q 11	An LTI system is characterized by the system function $$H(z) = \frac{3 - 4z^{-1}}{1 - 3.5z^{-1} + 1.5z^{-2}}$$	**20**	

	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 **OR** 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 $x(t) = e^{-\|t\|}$ (b) Find the inverse transform of the functions $X(s) = \frac{1}{s^2(s+2)}$		**CO4** **CO3**