



Unit 5 - Week 1: Linear System Theory, Fourier and Laplace Transforms

Course outline

How to access the portal

Prerequisite Assignment

MATLAB Download and Introduction

MATLAB Learning Modules

Week 1: Linear System Theory, Fourier and Laplace Transforms

- Introduction
- Linear Systems
- Homogeneous linear time invariant ordinary differential equations
- In-homogeneous linear time invariant ordinary differential equations
- Fourier transforms (Part 1)
- Fourier transforms (Part 2)
- Laplace transforms (Part 1)

Week-1 Assessment

The due date for submitting this assignment has passed. **Due on 2018-08-15, 23:59 IST.** As per our records you have not submitted this assignment.

Week-1 Assessment

1) Following differential equation represents

1 point

$$\frac{d^2x(t)}{dt^2} + \frac{tdx(t)}{dt} + 5x^2(t) = u(t)$$

- ☐ Linear Time Varying System
- ☐ Linear Time Invariant System
- ☐ Non-Linear Time Varying System
- ☐ Non-Linear Time Invariant System

No, the answer is incorrect.

Score: 0

Accepted Answers:

Non-Linear Time Varying System

2) The solution to the following homogenous differential equation is given by:

1 point

$$\ddot{x}(t) + 7\dot{x}(t) + 12x(t) = 0$$

with initial conditions,
 $x(0) = 0, \dot{x}(0) = 12$

- ☐ $12(e^{-3t} - e^{-4t})$
- ☐ $12(e^{3t} - e^{4t})$
- ☐ $12(e^{-3t} + e^{-4t})$
- ☐ $e^{-3t} - e^{-4t}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$12(e^{-3t} - e^{-4t})$

3) A unit step input is applied at time $t=0$ to a system which has the following input (u)-output (x) relationship:

$$\ddot{x}(t) + 7\dot{x}(t) + 12x(t) = 12u(t)$$

$$x(0) = 0, \dot{x}(0) = 12;$$

The response of the system at time $t = 1$ second (upto 2 decimal point) is given by

☒ Laplace transforms (Part 2)

☐ Quiz : Week-1 Assessment

☐ Solutions to Assessment 1

☐ New Lesson Module 1 lecture notes

Week 2:
Introduction to feedback control, Nyquist stability theory

Week 3 : Bode plots, Steps for performing control design, General controllers

Week 4: Bode-plot and root-locus based control design

Week 5: Control of systems with some known parameters, Introduction to 2-degree of freedom control

Week 6: 2-Degree of freedom control design for robustness

Week 7: Quantitative feedback theory (Part 1/2)

Week 8 : Quantitative feedback theory (Part 2/2)

Lecture Notes(Week 1 - 8)

Week 9: Fundamental properties of feedback systems

Week 10 : Nonminimum phase system

Week 11: Unstable systems

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 1.22 , 1.24

1 point

4) An LTI system has the impulse response $h(t)$ given by $h(t) = e^{-t} - e^{-2t}$. The system is excited by input $u(t) = \delta(t - 1) + \delta(t - 2)$. The output of the system at $t=3s$ is given by

☐ $e^{-1} - e^{-2}$

☐ $e^{-1} - e^{-4}$

☐ $e^{-2} - e^{-4}$

☐ $1 - e^{-2}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$e^{-1} - e^{-4}$

5) The Laplace transform of the following signal is given by

1 point

- ☐
☐
☐
☐

No, the answer is incorrect.

Score: 0

Accepted Answers:

6) If the step response of LTI system is

1 point

$$y(t) = 1 - e^{-9t}(\cos 40t + 9/40(\sin 40t))$$

The transfer function of the system is given by

☐ $1681/(s^2 + 18s + 1681)$

☐ $169/(s^2 + 18s + 169)$

☐ $25/(s^2 + 18s + 25)$

☐ $1681/(s^2 + 180s + 1681)$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$1681/(s^2 + 18s + 1681)$

7) The transfer function of a LTI system is given by $G(s) = 1/(s + 1)$. The response of the system for unit ramp input given by

1 point

- ☐

Week 12
Describing
functions

Assignment
solutions

☐ $(t + e^t - 1)$

☐ $(t + e^{-t} - 1)$

☐ $(t + e^{-t} + 1)$

☐ $(t + e^{-t})$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$(t + e^{-t} - 1)$

8) The transfer function of a system is given by $G(s) = (3s + 2)/(s^2 + s + 1)$ The system is initially at rest and is applied a unit step input at $t = 0$. If $x(t)$ is the output, the value of dx/dt at $t = 0$ is, (Hint: use initial value theorem) **1 point**

☐ 2

☐ 5

☐ 1

☐ 3

No, the answer is incorrect.

Score: 0

Accepted Answers:

3

9) The transfer function of a system is given by $G(s) = s(5s + 4)/(s^3 + s + 1)$ The system is initially at rest and is applied a ramp input at $t = 0$. If $x(t)$ is the output, the value of $x(\infty)$ **0 points**

☐ 4

☐ 5

☐ 1

☐ 0

No, the answer is incorrect.

Score: 0

Accepted Answers:

4

10) A second order system with unity DC gain and no zeros has a damping factor of $\xi = 0.2$ and an undamped natural frequency $\omega_n = 10$. The system is initially at rest and is applied a step input at $t = 0$. The value of the response $x(t)$ at $t = 0.1$ s (upto 2 decimal point) is

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 0.39,0.41

1 point

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