



Name: Roll No.:

Branch: Signature of Invigilator:

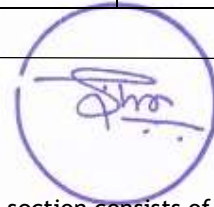
Semester: IVth

Date: 04/05/2022 (MORNING)

Subject with Code: EE255 SIGNALS AND SYSTEMS

Marks Obtained	Section A (30)	Section B (20)	Total Marks (50)

INSTRUCTION TO CANDIDATE



1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.
2. The booklet will be distributed to the candidates before 05 minutes of the examination. Candidates should write their roll no. in each page of the booklet.
3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.
4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.
5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.
6. Write on both side of the leaf and use pens with same ink.
7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.
8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.
9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.
10. Always maintain the highest level of integrity. Remember you are a BITian.
11. Candidates need to submit the question paper cum answer sheets before leaving the examination hall.

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

CLASS: B.Tech.
BRANCH: ALL

SEMESTER : IV
SESSION : SP/2022

SUBJECT: EE255 Signal and System

TIME: 2 Hrs.

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 2 sections A (Multiple Choice Questions) of 30 marks and section B (Descriptive Questions) of 20 marks.
 2. Candidates may attempt any 5 questions maximum of 20 marks from section B.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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Section A Multiple Choice Question (30 Marks)

1. What is Control System? [1]
 - a) Control system is a system in which the output is controlled by varying the input
 - b) Control system is a device that will not manage or regulate the behavior of other devices using control loops.
 - c) Control system is a feedback system that can be both positive and negative.
 - d) Control System is a system in which the input is controlled by varying the output
2. Which of the following is an example of an open loop system? [1]
 - a) Household Refrigerator
 - b) Respiratory system of an animal
 - c) Stabilization of air pressure entering into the mask
 - d) Execution of program by computer
3. The overall transfer function from block diagram reduction for cascaded blocks is : [1]
 - a) Sum of individual gain
 - b) Product of individual gain
 - c) Difference of individual gain
 - d) Division of individual gain
4. The overall transfer function of two blocks in parallel are : [1]
 - a) Sum of individual gain
 - b) Product of individual gain
 - c) Difference of individual gain
 - d) Division of individual gain
5. Transfer function of the system is defined as the ratio of Laplace Transform of output to Laplace transform of input considering initial conditions _____ [1]
 - a) 1
 - b) 2
 - c) 0
 - d) infinite
6. Transient response analysis is done for _____ systems. [1]
 - a) Unstable
 - b) Stable
 - c) Conditionally stable
 - d) Marginally stable
7. First order system is defined as: [1]
 - a) Number of poles at origin
 - b) Order of the differential equation

- c) Total number of poles of equation
 d) Total number of poles and order of equation
8. Laplace transform of unit impulse signal is : [1]

- a) A/s
 b) A
 c) 1
 d) 1/s

9. The damping ratio and peak overshoot are measures of: [1]

- a) Relative stability
 b) Speed of response
 c) Steady state error
 d) Absolute stability

10. Zeroes are defined as: [1]

- a) Roots of the denominator of the closed loop transfer function
 b) Roots of the numerator of the closed loop transfer function
 c) Parts of the numerator
 d) Parts of the denominator

11. Steady state refers to [1]

- a) Error at the steady state
 b) Error at the transient state
 c) Error at both state
 d) Precision

12. What will be the nature of time response if the roots of the characteristic equation are located on the s-plane imaginary axis? [1]

- a) Oscillations
 b) Damped oscillations
 c) No oscillations
 d) Under damped oscillations

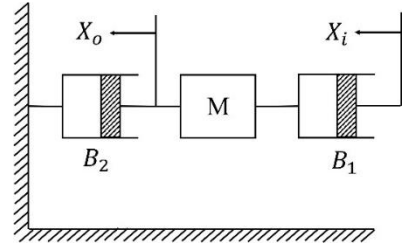
13. Which among the following is a unique model of a system? [1]

- a) Transfer function
 b) State variable
 c) Block diagram
 d) Signal flow graphs

14. State space analysis is applicable even if the initial conditions are [1]

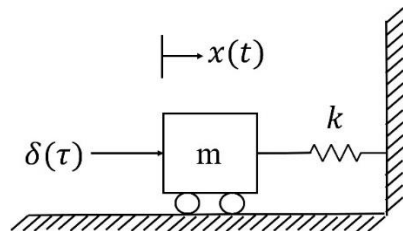
- a) Zero
 b) Non-zero
 c) Equal
 d) Not equal

15. For the mechanical system with mass and viscous friction components as shown below, find $\frac{X_o(s)}{X_i(s)}$. [2]



- (A) $\frac{B_1}{Ms+B_1+B_2}$
 (B) $\frac{B_2}{Ms+B_1+B_2}$
 (C) $\frac{B_1}{Ms^2+(B_1+B_2)s}$
 (D) $\frac{B_2}{Ms^2+(B_1+B_2)s}$

16. A mechanical system is shown in figure. The system is set into motion by applying a unit impulse force. Assuming that the system is initially at rest and ignoring friction, what is the displacement $x(t)$ of mass? [2]



- (A) $\frac{1}{\sqrt{k}} \exp(-mt)$
 (B) $\frac{1}{\sqrt{mk}} \sin(t)$
 (C) $\frac{1}{\sqrt{mk}} \sin(\sqrt{\frac{k}{m}} t)$
 (D) $\frac{1}{\sqrt{mk}} (\sqrt{\frac{k}{m}} t)$

17. The type of systems which are characterized by input and the output quantized at certain levels are called as [1]
- Analog
 - discrete
 - continuous
 - digital
18. A system is said to be defined as non-causal, when [1]
- the output at the present depends on the input at an earlier time
 - the output at the present does not depend on the factor of time at all
 - the output at the present depends on the input at the current time
 - the output at the present depends on the input at a time instant in the future
19. Discrete time signal is derived from continuous time signal by _____ process. [1]
- Addition
 - Multiplying
 - Sampling
 - Addition and multiplication
20. The step function $u(t)$ is integral of _____ with respect to time t . [1]
- Ramp function
 - Impulse function
 - Sinusoidal function
 - Exponential function
21. What are the mathematical tools to convert a system from a time domain to frequency domain? [1]
- Fourier series, Fourier transform, Laplace transform, Z-transform
 - Fourier series only
 - Fourier series and Laplace transform only
 - Fourier series, Fourier transform and Laplace transform only
22. The necessary condition for convergence of the Laplace transform is the absolute integrability of $f(t)e^{-\sigma t}$. [1]
- True
 - False
23. Find the Laplace transform of $\delta(t)$. [2]
- 1
 - 0
 - ∞
 - 2
24. How are the convolution integral of signals represented? [2]
- $x(t)+h(t)$
 - $x(t)-h(t)$
 - $x(t)*h(t)$
 - $x(t)**h(t)$
25. Find the Laplace transform of $\cos\omega t$ $u(t)$. [2]
- $s/(s^2+\omega^2)$
 - $s/(s^2-\omega^2)$
 - $\omega/(s^2+\omega^2)$
 - $\omega/(s^2-\omega^2)$

Section B Descriptive Questions (Max. 20 Marks)
Attempt any five

1. Consider the circuit of Fig.1 [4]

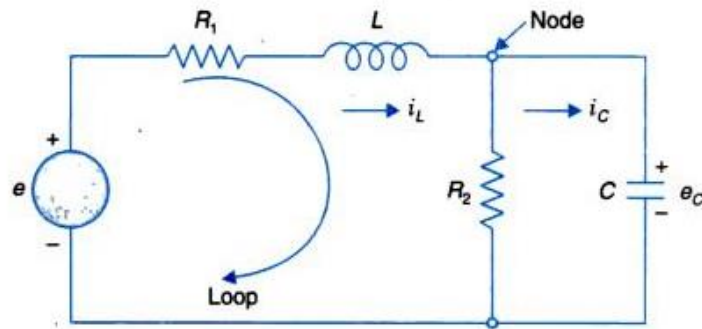


Fig. 1

Determine the transfer function $E_c(s) / E(s)$.

2. Write the state variable equation of the circuit shown in Fig.1 in matrix form. [4]
3. Draw the electrical analogous of the mechanical system shown in Fig. 2. [4]

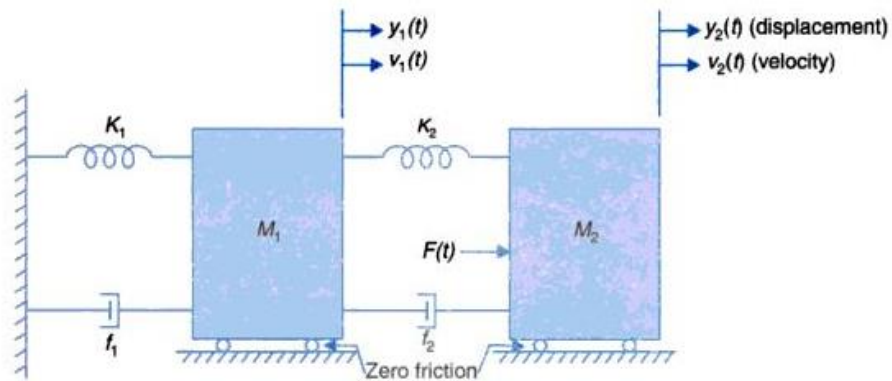


Fig.2

4. An exponential function $x(t) = e^{-2t}$ shown in Fig. 3 is delayed by 1 second. Sketch and mathematically describe the delayed function. Repeat the problem with $x(t)$ advanced by 1 second. [4]

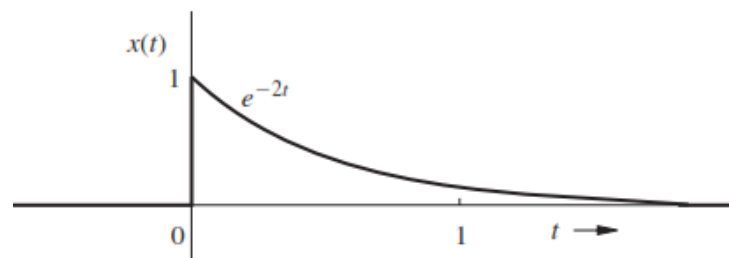


Fig.3

5. Differentiate between [4]
- i. energy signal and power signal
 - ii. stable and unstable system.

6. List the time domain specifications for a second order system and define them when the system is subjected to a unit step input. [4]
7. List the limitations of Routh-Hurwitz criterion for stability analysis. Modify the criterion for relative stability analysis. [4]
8. Evaluate the stability of a system having the following characteristic equation $S^5 + 5S^4 + 11S^3 + 23S^2 + 28S + 12 = 0$ [4]
9. Define state, state vector, state variable and state space. [4]
10. Mention the importance of Fourier transform (FT) in system analysis. [4]

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