Printed Pages:02 **Sub Code: ROE-071**

Paper Id: 231188 **Roll No.** | | | | | | | | | | |

B. TECH.
(SEM-VII) THEORY EXAMINATION 2022-23
MODELLING AND SIMULATION OF DYNAMIC SYSTEMS

Time: 3 Hours ***Total Marks: 70***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

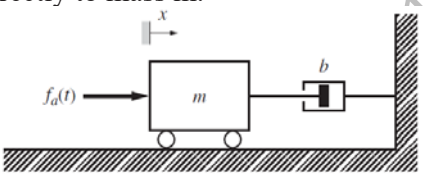
1. Attempt *all* questions in brief. 2 x 7 = 14

(a) What do you mean by System modeling?
(b) Discuss the use of nonlinear algebraic equation to obtain mathematical model with example
(c) What is Causality?
(d) Differentiate lumped parameter model and distributed parameter model
(e) What are translatory systems?
(f) What are the advantages in transfer function model analysis?
(g) What issystem identifications?

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

(a) What is simulation? What is its need, advantages and disadvantages of simulation and modelling?
(b) Define Transformer and Gyrator in bond graph system with neat sketch?
(c) Figure shows a 1-DOF mass–damper system. Displacement x is measured from an equilibrium positionwhere the damper is at the "neutral" position. External force $f_a(t)$ is applied directly to mass m.



(d) What do you mean by frequency response and bode plots. Explain in brief.
(e) Define parameter estimation methods with suitable Example.

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a) What do you mean by modeling of dynamic system? How to formulate the model for a dynamic system?
(b) Define the Methods of drawing bond graph model for Mechanical systems? Define with the help of suitable example.

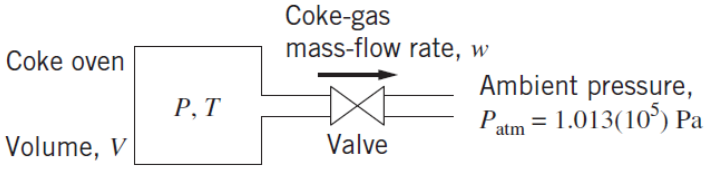
4. Attempt any *one* part of the following: 7 x 1 = 7

(a) A hydraulic tank has the following pressure–mass relationship:

$$P = 1.013(10)^5 + 3.6m \text{ N/m}^2$$

where fluid mass m is in kg. The tank holds water (density ρ=1000 kg/m3) and has a constant circularcross-sectional area A. Compute the fluid capacitance C of the tank.

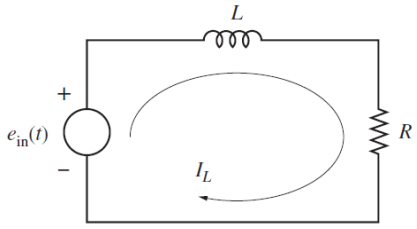
(b) A coke oven with pressure P, fixed volume V =25m^3, and temperature T. Ambientpressure is P_{atm} =1.013(10^5) Pa.



Derive the mathematical model of the pneumatic system with compressible flow through the sharpedgedorifice (valve) to atmospheric conditions.

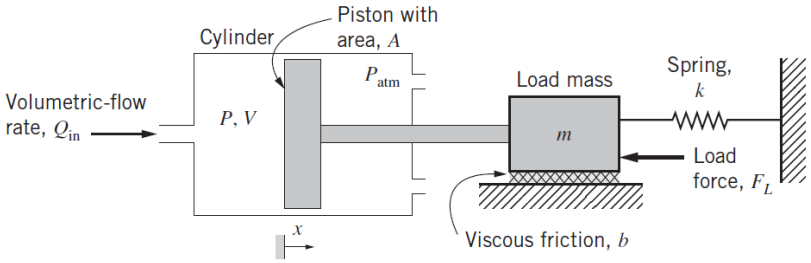
5. Attempt any *one* part of the following: 7 x 1 = 7

(a) The Figure shows a series RL circuit with a voltage source. Derive the



mathematical model of the electrical system

(b) A simple hydraulic actuator with an input flow rate Qin to the cylinder and a piston connectedto the load mass. Derive the mathematical model of the hydromechanical system.



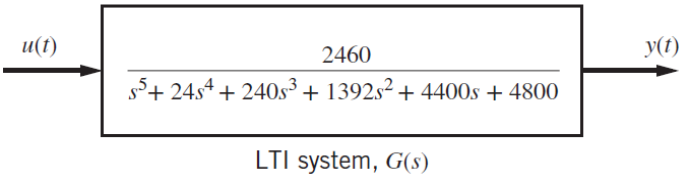
6. Attempt any *one* part of the following: 7 x 1 = 7

(a) Determine the complete solution $y(t)$ of the following second-order linear differential equation

$$2\ddot{y} + 8\dot{y} + 6y = 10 \sin 4t$$

with initial conditions $y(0) = 2$ and $\dot{y}(0) = -1$.

(b) Given the linear system shown in Fig., determine the characteristics of the natural response $y_H(t)$ and estimate it's time to reach steady state if the input u(t) is a unit-step function.



7. Attempt any *one* part of the following: 7 x 1 = 7

(a) How validation and verification of the simulation model is done? Give the method with suitable example.

(b) Explain the different methods employed for validation and verification of simulation models.