VIT

Vellore Institute of Technology

Vellore – 632014, Tamil Nadu, India
SCHOOL OF ELECTRICAL ENGINEERING
FALL SEMESTER 2023-2024
CAT-I

SLOT: G2 + TG2

Programme Name & Branch : B.Tech (EEE, EIE)   Course Code: BEEE303L

Course Name   : Control Systems

Faculty Members   : Dr. V. Bagyaveereswaran   Class Number(s): 2936, 2938

Dr. E. VinodhKumar

Date of the Examination   : 16 – 09 – 2023

Duration : 90 minutes

Max. Marks : 50

General instruction(s): Answer all the questions

Q. No	Question	Marks

1. A high-precision positioning slide is shown in Figure 1. Determine the transfer function $X_p(s)/X_m(s)$ when the drive shaft friction is $b_d = 0.7$, the drive shaft spring constant is $k_d = 2$, $m_c = 1$, and the sliding friction is $b_s = 0.8$.   [10]
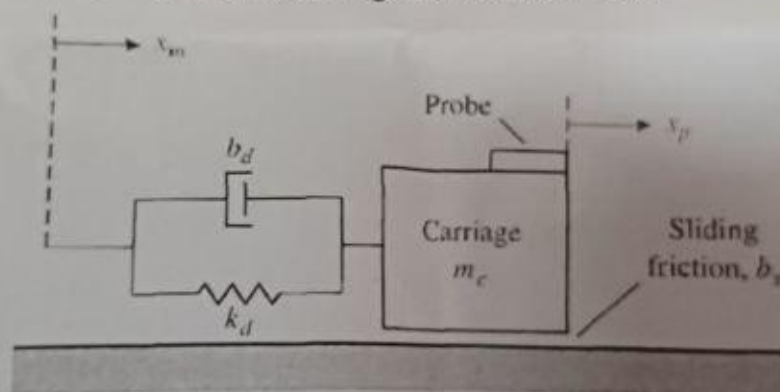

Figure 1

2. Write the differential equations governing the rotational mechanical system shown in Figure 2. Also draw the torque-voltage and torque-current analogous circuits.   [10]
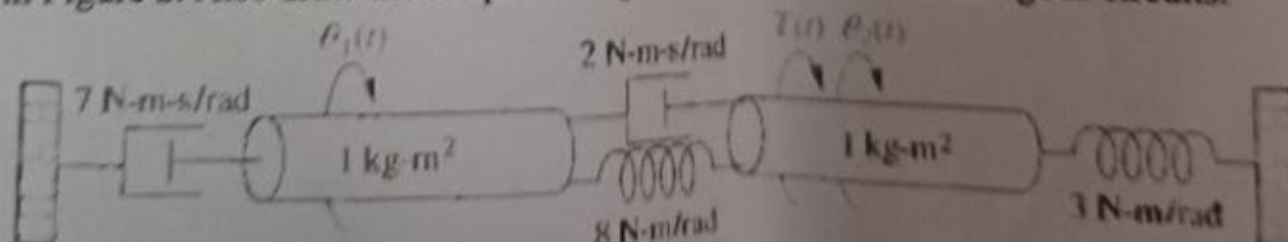

Figure 2

3. A control engineer, N. Minorsky, designed an innovative ship steering system in the 1930s for the U.S. Navy. The system is represented by the block diagram shown in Figure 3, where $Y(s)$ is the ship's course, $R(s)$ is the desired course, and $A(s)$ is the rudder angle. Find the transfer function $Y(s)/R(s)$.   [10]