C

B.Tech. Degree VIII Semester Examination in Marine Engineering May 2019

MRE 1804 MARINE CONTROL ENGINEERING AND AUTOMATION
(*2013 Scheme*)

Time: 3 Hours   Maximum Marks: 100

(5 × 20 = 100)

I. (a) Explain the following with neat diagrams: (8)
        (i) Oil mist detector
        (ii) Viscosity sensors
   (b) Explain with neat diagram mechanical type tachometers.   (6)
   (c) Explain with neat sketches any two temperature measuring devices.   (6)

OR

II. (a) Explain with a diagram the force balance transducers.   (6)
   (b) Draw and explain synchros.   (6)
   (c) Explain the working of flapper nozzle with the help of a neat diagram.   (8)
      Explain its implementation in electro-pneumatic signal converter.

III. (a) Define the following terms with respect to process control with an example: (6)
        (i) Process variable
        (ii) Manipulated variable
        (iii) Measured variable
   (b) Explain different system lags.   (4)
   (c) Explain the following with diagrams: (10)
        (i) Cascade control system
        (ii) ON-OFF control system

OR

IV. (a) Differentiate open loop and closed loop control systems.   (6)
   (b) Explain proportional controllers. Explain their advantages and   (14)
      disadvantages. Explain the need of integral and derivative controllers with
      proportional control system with suitable examples.

V. (a) Explain diaphragm actuators with neat diagrams.   (4)
   (b) Unit step response of a system is given by $c(t) = te^{-t} + e^{-4t}\sin 5t$. Find   (6)
      the transfer function of the system.
   (c) A closed loop servo system is represented by transfer function   (10)
      $\dfrac{C(S)}{R(S)} = \dfrac{64}{s^2 + 8s + 64}$. Determine the undamped natural frequency,
      damping ratio, rise time, peak time, maximum overshoot and settling time
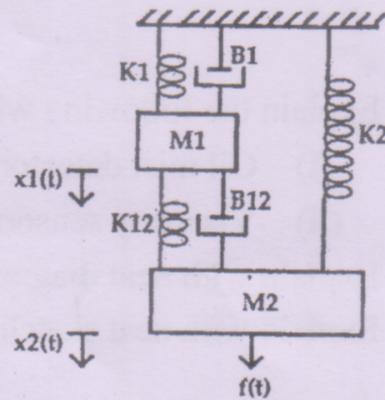   for a unit step input.

OR

(P.T.O.)

VI. (a) Reduce the following block diagram and find the transfer function $\dfrac{C(s)}{R(s)}$. (10)
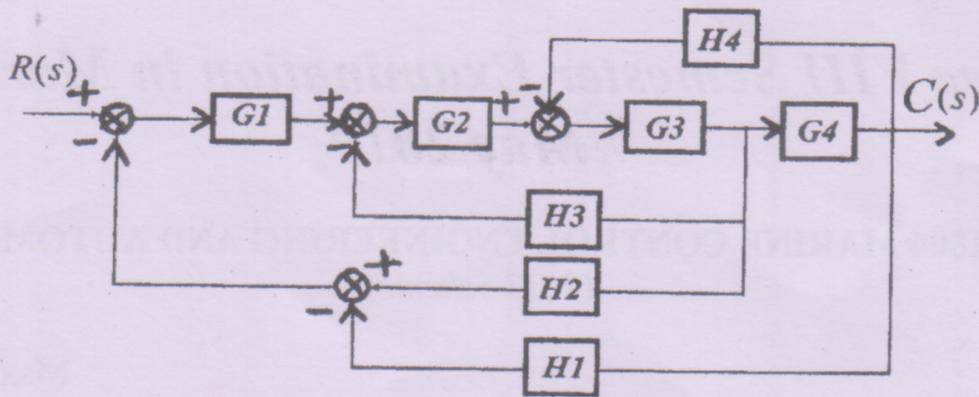
(b) Write the differential equations governing the mechanical system shown in the figure and find the transfer function: (10)

VII. (a) For a unit feedback system having open loop transfer function $\dfrac{k(s+2)}{s^2(s^2+7s+12)}$. Determine the type of the system, error constant and range of k for which steady state error due to parabolic input less than 0.1. (10)

(b) The characteristic polynomial of a system is given by: (10)

$$s^6 + 5s^5 + 14s^4 + 40s^3 + 64s^2 + 80s + 96 = 0$$

Determine the location of roots on s-plane and hence stability of the system using Routh Hurwitz stability criterion. Find the frequency at which system will oscillate.

OR

VIII. (a) Explain Nyquist stability criterion. (5)

(b) Sketch the Nyquist contour whose open loop transfer function given by (15)

$G(s)H(s) = \dfrac{K(s-2)}{(s+1)^2}$. Find the range of k for stability.

IX. (a) Discuss the instrumentation requirements of a UMS class vessel. (10)

(b) Explain jacket water cooling control system of main machinery unit. (10)

OR

X. (a) Sketch and describe the control system used for automatic combustion control in marine boiler. (10)

(b) With a neat sketch describe the system used for feed water control two and three element type. (10)

***