BT MRE–VII–02.21– 1315 Reg. No. | | | | | | | | |

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B.Tech. Degree VII Semester Examination in Marine Engineering
February 2021

MRE 1804 MARINE CONTROL ENGINEERING AND AUTOMATION

(*2013 Scheme*)

Time: 3 Hours Maximum Marks: 100

(5 × 20 = 100)

I. (a) Explain the working of Electro-pneumatic (I/P) converter with neat diagram. (8)

(b) Explain the working of variable inductance and variable capacitance type transducer. (6)

(c) Explain the working of any two type of flow measuring devices with neat sketches. (6)

OR

II. (a) Describe about Flapper nozzle working principle with the help of any example and neat diagram. (6)

(b) Along with neat diagrams give details about the working of (8)
(i) Oil mist Detector
(ii) Salinity Indicator

(c) Describe the working principle of any one type of viscosity sensor (viscometer) with neat diagram. (6)

III. (a) Differentiate closed loop and open loop control systems with an example. Give its advantages and disadvantages along with necessary diagrams. (6)

(b) What is process control? Explain and differentiate the terms with respect to process control (i) process variable (ii) measured variable (iii) transfer lag. (9)

(c) Describe the working principle of Two step (ON-OFF) Control with an example and give its advantages and disadvantages. (5)

OR

IV. (a) Explain proportional controller. What is the effect of adding integral and derivative function to it? Explain with the help of an example. (15)

(b) Explain the working of cascade control with necessary diagrams. Give its merits and demerits. (5)

V. (a) Explain the working of piston actuator with neat diagram (4)

(b) Obtain the response of unity feedback system with open loop transfer function $G(s)=\frac{4}{s(s+5)}$, when the input given is a unit step function. (6)

(c) The unity feedback system is characterized by an open loop transfer function (10)

$$G(s)=\frac{k}{s(s+10)}$$

Determine the gain K, So that the system will have a damping ratio of 0.5 for this value of K. Determine damped natural frequency of oscillation, settling time, percentage of peak overshoot and peak time for a unit step input.

OR

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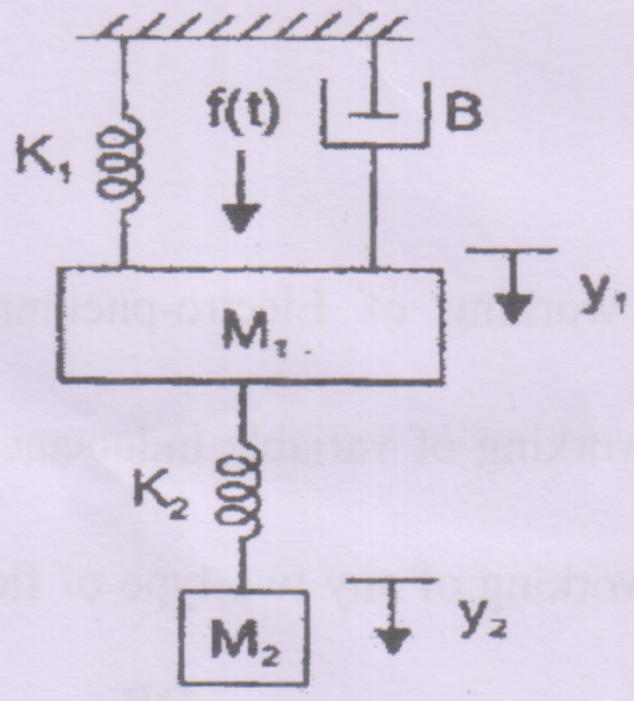
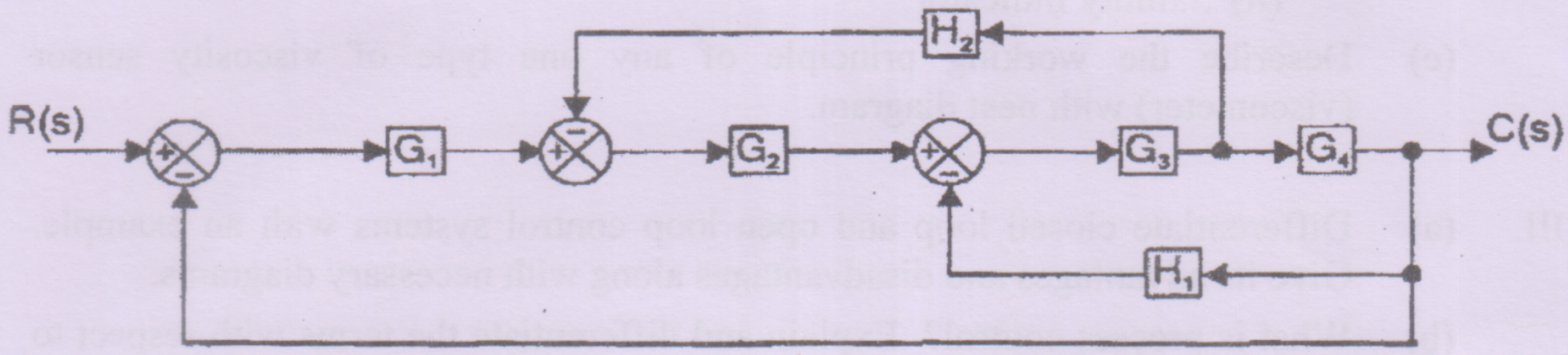
VI. (a) Determine the transfer function $\frac{Y_2(S)}{F(S)}$ of the system shown in figure. (10)



(b) Determine the overall transfer function $\frac{C(S)}{R(S)}$ for the system shown in figure. (10)



VII. (a) A unity feedback system has the forward transfer function (10)

$$G(s) = \frac{k_1(2s+1)}{s(5s+1)(1+s)^2}.$$

Determine:

(i) Type of system
(ii) Error constants
(iii) Steady state error for unit ramp input
(iv) The minimum value of K_1 so that the steady state error due to unit ramp input is less than 0.1

(b) Construct Routh array and determine the stability of the system whose characteristic equation is $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$. (10)

Also determine the number of roots lying on right half of S-plane, left half of S-plane and on imaginary axis. Find the frequency at which system will oscillate.

OR

(Continued .....3)

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

(b) Draw the Nyquist plot for the system whose open loop transfer function is (15)

$$G(s)H(s)=\frac{k}{s(s+2)(s+10)}.$$

Determine the range of K for which closed loop system is stable.

IX. (a) Explain the working of the system used for feed water control two and three element type with neat diagrams. (10)

(b) Explain the instrumentation requirements for a UMS class vessel. (10)

OR

X. (a) Explain the working of Jacket water cooling control system of main engine unit. (10)

(b) Explain with a neat diagram lubricating oil temperature control in main engine unit. (10)

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