

INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

End Semester Examinations - June/July 2019 M. Tech. (Marine Engineering and Management) Semester-II

Instrumentation, Automation & Control Systems (PG13T1202)

Date: 25-06-2019

Maximum Marks: 60

Time: 3hrs

Pass Marks: 30

Answer any five questions

All questions carry equal marks. (5 x 12=60)

1. (a) Sketch and describe the working of a Electro-magnetic Flowmeter.(6)
(b) Explain Boiler Water level measurement by Igema Remote Water Level Indicator with sketch. (6)
2. (a) Explain with sketch Thermocouple Temperature measurement and materials used in various ranges of temperature measurement. (6)
(b) Describe Piezoelectric Detecting Element for Pressure Sensor and explain different connection for pressure variation measurement. (6)
3. Explain how linear motion can be transduced in to electrical signal by Linear Variable Differential Transformer (LVDT) describing its construction, working, advantages, disadvantages and uses. (12)
4. (a) Explain with a block diagram the working of auxiliary boiler automatic combustion control. (6)
(b) What is "swelling" and "shrinkage" phenomena in boiler water level and show with diagram how it is overcome. (6)
5. (a) Explain what is negative feedback Amplifier in control system. How it ensures Gain Stability, Reduction in distortion, Improvement in frequency response and Improvement in circuit stability. (6)
(b) Draw a block diagram of main propulsion engine lubricating oil temperature control with an Electronic (P+I+D) Controller showing its function. (6)

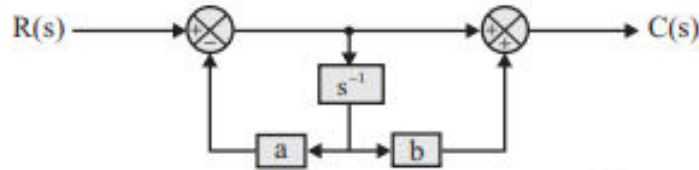
6. (a) For the given characteristic equation of a closed loop control system $s^3 + 3Ks^2 + (k + 2)s + 4 = 0$ find the range of k so that system is stable. (6)

(b) Draw the signal flow graph for the following set of algebraic equations

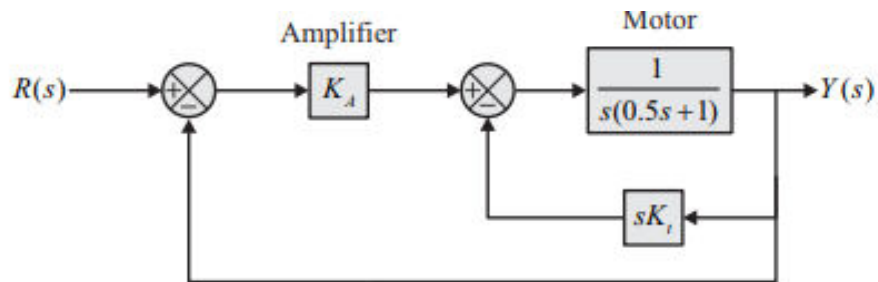
$$\begin{aligned} y_2 &= -ay_1 - gy_3 \\ y_3 &= ey_2 + cy_4 \\ y_4 &= by_2 - dy_4 \end{aligned}$$

Hence, find the gain y_2/y_1 (6)

7(a) The block diagram for a particular control system is shown in the figure. What is the transfer function $C(s)/R(s)$ for this system? (6)



(b) Block diagram model of a position control system is shown in figure, In absence of derivative feedback ($k_t = 0$) determine damping ratio of the system for amplifier gain $K_A = 5$. Also find the steady state error to **unit ramp** input. (6)



8. A control system has $\frac{G(s)}{H(s)} = \frac{K}{s(s+4)(s^2+4s+20)}$ ($0 < K < \infty$) What is the number of breakaway points in the root locus diagram? (12)
