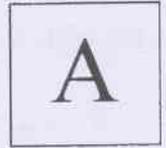


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B.Tech. Degree VIII Semester Regular Examination in Marine Engineering June 2023

19-208-0810 MARINE CONTROL ENGINEERING AND AUTOMATION (ELECTIVE II)
(2019 Scheme)

Time: 3 Hours

Maximum Marks: 60

Course Outcome

On successful completion of the course, the students will be able to:

- CO1: Understand the different measuring devices and signal transmitting devices.
 CO2: Gain knowledge regarding control theory and different types of controllers.
 CO3: Understand details of correcting units, system analysis and mathematical models.
 CO4: Understand about the stability and performance of control system.
 CO5: Gain knowledge on applications of control system on ships.

Bloom's Taxonomy Levels (BL): L1 – Remember, L2 – Understand, L3 – Apply, L4 – Analyze, L5 – Evaluate,
 L6 – Create

PI – Programme Indicators

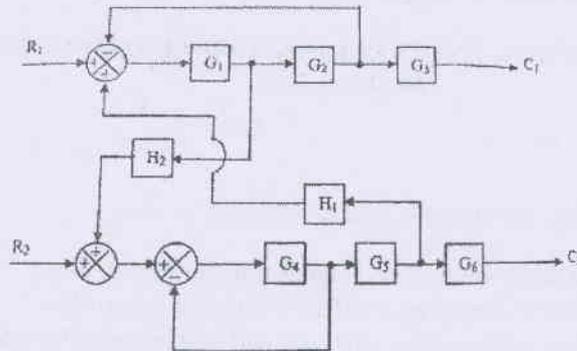
(Answer **ALL** questions)

(5 × 15 = 75)

		Marks	BL	CO	PI
I.	(a) Elaborate on the various temperature measuring instruments that are based on the principles of expansion of solids, liquids and gases.	8	L2	1	1.6.12
	(b) Explain the principle of operation of flapper nozzle system in a pneumatic transducer. Discuss how they can be used in the various electro pneumatic signal converters.	7	L2	1	1.6.12
OR					
II.	(a) Discuss the principle of operation of a photoelectric cell. Explain how photoelectric cell can be used for oil in water sensing and oil mist detection applications.	8	L2	1	1.6.12
	(b) Write short notes on: (i) Revolution counter with timer (ii) Force balance transducer.	7	L2	1	1.6.12
III.	(a) Define the various terminologies used in a closed loop control system with the aid of a cooling system for lubricating oil in a heat exchanger.	7	L2	2	1.6.12
	(b) Explain how proportional, two term and three term control actions are generated with the aid of force balance beam type controllers.	8	L2	2	1.6.12
OR					
IV.	(a) Write short notes on: (i) Two step and Three term control methods (ii) Cascade control method.	8	L2	2	1.6.12
	(b) Discuss the principle of operation of various relays and ON-OFF switches used in automatic control systems.	7	L2	2	1.6.12

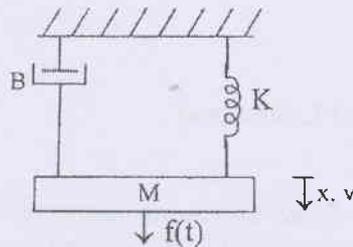
(P.T.O)

	Marks	BL	CO	PI
V. (a) Elaborate on the principle of operation of piston actuators.	6	L2	3	1.2,4,12
(b) Determine the transfer function $C1/R1$ for the block diagram shown below.	9	L4	3	1.2,4,12



OR

VI. (a) For the mechanical system shown below, derive the transfer function and obtain the force – voltage and force – current analogous circuits.	9	L4	3	1.2,4,12
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(b) Measurements conducted on a servomechanism show the system response to be $c(t) = 1 + 0.2 e^{-60t} - 1.2 e^{-10t}$ when subjected to a unit step input. Obtain an expression for the closed loop transfer function. Determine the undamped natural frequency of oscillation and the damping ratio.	6	L4	3	1.2,4,12
VII. (a) The open loop transfer function of a unity feedback control system is $G(s) = K / (s + 2)(s + 4)(s^2 + 6s + 25)$. Determine the range of 'K' for which the system will be stable and the value of 'K' which will cause sustained oscillations in the closed loop system.	9	L4	4	1.2,4,12
(b) For a servomechanism with open loop transfer function $G(s) = 10 / s^2(s + 1)(s + 2)$ what type of input signal give rise to a constant steady state error and calculate the value.	6	L4	4	1.2,4,12
OR				
VIII. (a) Construct the Nyquist plot for the system whose open loop transfer function is $G(s)H(s) = K / s(s + 2)(s + 10)$. Determine the range of 'K' for which the closed loop system is stable.	10	L4	4	1.2,4,12
(b) State Nyquist stability criterion. What is meant by a Nyquist contour and discuss the three situations stated by Nyquist stability criterion that judge a system as unstable?	5	L2	4	1.2,4,12
IX. (a) Explain the automatic combustion control and air fuel ratio control techniques deployed in marine boilers.	10	L2	5	1.6
(b) Discuss the fuel oil viscosity control system used in marine applications.	5	L2	5	1.6
OR				
X. (a) Explain the jacket cooling water and fuel valve cooling water systems used in marine applications.	9	L2	5	1.6
(b) Elaborate on the instrument requirements for UMS classification.	6	L2	5	1.6