

**INDIAN MARITIME UNIVERSITY**  
(A Central University, Government of India)

May/ June 2017 End Semester Examinations  
B.Tech. (Marine Engineering) Seventh Semester  
(AY 2009-2014 batches)

**Advanced Marine Control Engineering & Automation**  
**(UG11T2702/UG11T1802)**

Date : 14.06.2017

Maximum Marks: 100

Time: 3 Hrs

Pass Marks : 50

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**Part – A**

**(10 x 3=30 Marks)**

**(All questions are compulsory)**

1. (a) Write the advantages and disadvantages of an open-loop and closed loop system.
- (b) Write down the definition of a system and system transfer function.
- (c) What is the difference between type and order of a system?
- (d) What are the effects of feedback?
- (e) What are the time domain specifications?
- (f) Explain - Stack type controller.
- (g) Explain - Flapper nozzle characteristic?
- (h) Write down the advantages of central cooling system for machinery.
- (i) Explain- Viscosity monitoring.
- (j) Write down short note on variable inductance transducer.

**Part – B**

**(5 x 14=70 Marks)**

**(Answer any FIVE of the following)**

2. (a) Derive the expression and draw the system graph for the second order hydraulic system. (7 Marks)

- (b) Draw the electric analog of the mechanical system shown in figure 1 both in force-voltage (F-V) and force-current (F-i) analogy. (7 Marks)

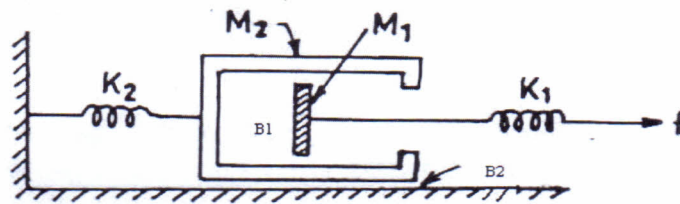


Figure 1: Mechanical system.

2. (a) Find the overall transfer function of the system shown in figure 2. (7 Marks)

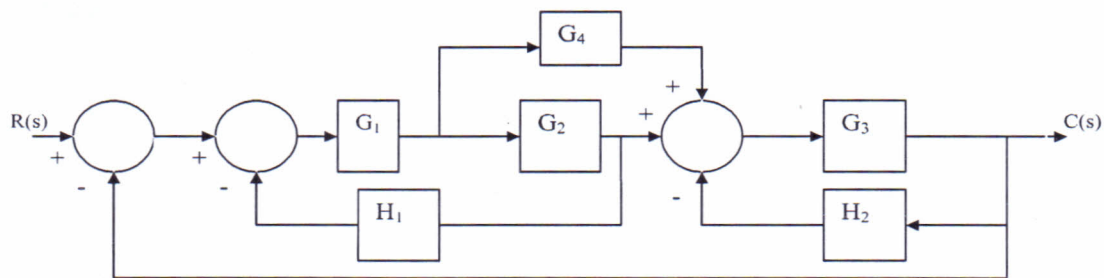


Figure 2.

- (b) For the unity feedback system having  $G(s) = K/[s(sT+2)]$ , find the following: (i) the factor by which the gain  $K$  should be multiplied to increase the damping ratio from 0.15 to 0.6. (ii) the factor by which the time constant  $T$  should be multiplied to reduce the damping ratio from 0.8 to 0.4. (7 Marks)
4. (a) Find the overall transfer function for PI controller by using three operational Amplifier. (7 Marks)
- (b) Determine damping ratio ( $\xi$ ), overshoot ( $\%M_p$ ) and settling time ( $t_s$ ) if a PD controller,  $K_D = 1/30$  is introduced as shown in fig.3. (7 Marks)

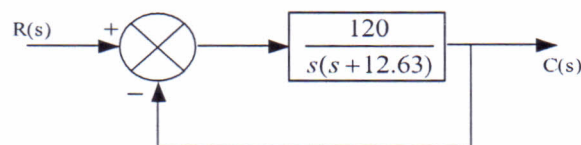


Fig. 3.

5. (a) Describe with sketch valve positioner for a diaphragm-actuated control valve. (7 Marks)
- (b) Explain 3-term control (PID) characteristics. (7 Marks)
6. (a) Describe with line diagrams the functioning of a boiler combustion control system. (7 Marks)
- (b) Explain the compressor control operation with sketch. (7 Marks)
7. (a) Describe the functioning of an ON-OFF control switch used for starting and stopping of a sanitary water hydrophone pump on board your vessel. (7 Marks)
- (b) Explain the computer supervisory control system. (7 Marks)
8. (a) Explain the lubricating oil temperature control system on ship. (7 Marks)
- (b) For a system having  $\frac{C(s)}{R(s)} = \frac{20}{s^2 + 7s + 25}$  find its time response specifications and expression for output with unit step input. (7 Marks)

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