

INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

END SEMESTER EXAMINATION December 2017

Programme: B. Tech (Marine Engineering)

Semester: VII

Subject Name: Advanced Marine Control Engineering & Automation

Subject Code: UG11T2702/1802

Date: 06.12.2017

Maximum Marks: 100

Time: 3HRS

Pass Marks: 50

PART – A

Marks: 10X3=30

(All questions are compulsory)

1. (a) State the effects of feedback.
- (b) Define linear and non-linear control system.
- (c) A system having input 'x' and output 'y' is represented by, $\ddot{y}(t)+3\dot{y}(t)+2y(t)+y(t)=\ddot{x}(t)+2\dot{x}(t)+3x(t)$. Find the transfer function of the system.
- (d) Define the positional servomechanism and rate servomechanism.
- (e) Define the Mason's Gain Formula.
- (f) For a unity feedback system having $G(s)=\frac{35(s+4)}{s(s+2)(s+5)}$; find all error coefficients.
- (g) Write down nozzle-flapper characteristic?
- (h) Explain cascade control with diagram.
- (i) Explain the working principle of synchros.
- (j) Define Sensitivity of a Control system.

PART – B

Marks: 5X14 =70

(Answer any 5 of the following)

2. Show that common mechanical coupling device, i.e. Gear trains also have electrical analogs of transformer. 14
3. (a) Find out $\frac{C(s)}{R(s)}$ of the following signal flow graph figure 1 using Mason's gain formula. 7

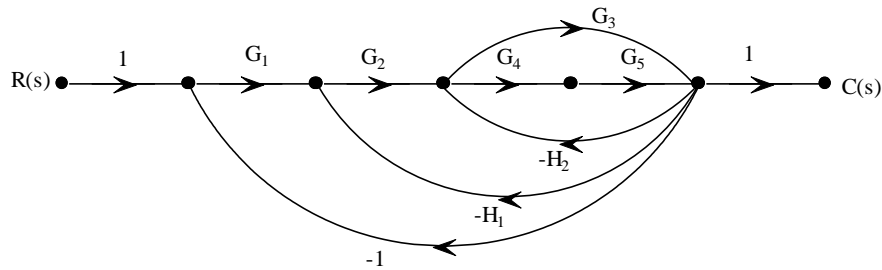


Figure 1.

(b) The open loop transfer function of a unity feedback system is given by, $G(s) = \frac{K}{s(1+sT)}$, where 'K' and 'T' are positive constants. By what factor should the amplifier gain be reduced so that the peak overshoot of unit step response of the system is reduced from 75% to 25%.

4. (a) Find the overall transfer function for PID controller by using operational Amplifier circuit.

(b) Refer to figure 2, calculate following: (i) Determine damping ratio (ξ) and natural frequency (ω_n) without K_D . (ii) K_D for damping ratio ($\xi = 0.60$) with controller.

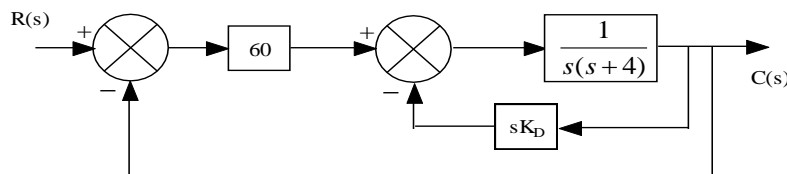


Figure 2.

5. (a) Sketch and explain diaphragm actuator with positioner.

(b) Write short note on Direct Digital Control system.

6. (a) Explain with the help of block diagram Central cooling water system mentioning HT and LT zone.

(b) Sketch and describe Electro pneumatic converter (IP converter).

7. (a) Describe with the sketch Marine boiler electric combustion control.

(b) What are the main instruments required for UMS class vessel.

8. (a) What do you mean basic control action of controllers and also classify?

(b) In Fig. 3, $G_1(s) = \frac{\omega_n^2}{s^2 + 2\xi\omega_n s + \omega_n^2}$. Where $\omega_n = \frac{8\pi}{T}$, $T = 6.28$ sec and $\xi = 0.3$. Find the open-loop and closed-loop sensitivities for changes in A and H(s).

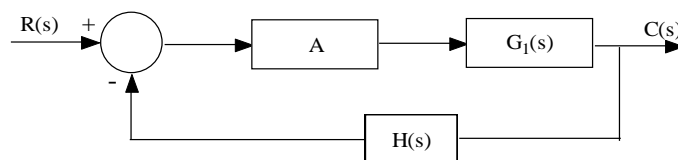


Figure 3.
