

INDIAN MARITIME UNIVERSITY
 (A Central University, Government of India)
M.Tech (Marine Engineering & Management)
 May – June 2018 End Semester Examination
 Semester: II

Instrumentation, Automation & Control Systems (PG13T1202)

Date: 29.05.2018
Time: 3 Hrs.

Maximum Marks: 100
Pass Marks: 50

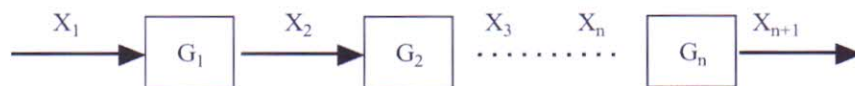
Answer any FIVE questions.

Marks: 5X20=100

Note: Question Number 1 is Compulsory.

- 1.(a) On what principle the Thermocouple sensor works for temperature measurement?
- (b) Draw a Pneumatic Proportional Controller and explain offset in it. How it can be minimized and overcome?
- (c) Sketch an IP Converter (Electronic to Pneumatic Transducer).
- (d) Write the working principle of any one of the following :-
 - (a) MEMS based sensors
 - (b) Piezo electric sensor
 - (c) Quadrature Encoder Sensor
- (e) Difference between Accelerometer and Gyroscope sensors.
- (f) Write short note on any one of the following :
 - (a) Thermocouple Vacuum Pressure Gauge
 - (b) Ionisation Gauge for low pressure measurement
- (g) The characteristics equation of system is $S^4+6S^3+11S^2+6S+K=0$, what restriction must be placed upon the parameter k in order to insure that the system is stable.
- (h) Prove that for a causal block the transfer function is given by

$$G=G_1.G_2.G_3..... G_n = \prod_{i=1}^n G_i$$



- (i) Show that steady state error $e(\infty)$ of a stable typt-1 unity feedback system when the input is a unit step function is related to the position error constant

$$e(\infty) = \lim_{t \rightarrow \infty} e(t) = \frac{1}{1+k_p} \quad \text{where } k_p = \lim_{s \rightarrow 0} G(s)$$

the unit feedback control system whose transfer function is $G(s) = \frac{10(s+1)}{(s+1)(s+4)}$

- 2.(a) Sketch a simple block diagram of Electronic (P+I+D) Control of a large diesel propulsion engine Lubricating Oil Inlet Temperature.
- (b) Explain with line diagram the function of Electronic (Proportional + Integral + Derivative) Controller.
- 3.(a) Sketch and explain a Capacitive Level Sensor.
- (b) Sketch and describe an Electromagnetic Flowmeter.
4. (a) Under what condition a Cascade Control is most suitable?
- (b) Draw a line diagram to show the application of Cascade Control with Range Splitter in main propulsion engine Jacket Cooling Water Outlet temperature control.
- 5.(a) Explain with a sketch the construction and working of a Linear Variable Differential Transformer (LVDT) Inductive Sensor.
- (b) What is the purpose of a Valve Positioner in a Pneumatic Diaphragm operated Valve? Show its function with sketch.
- 6.(a) What is a Negative Feed Back Amplifier? How it ensures (i) Gain Stability, (ii) Reduction in distortion, (iii) Improvement in Circuit Stability.
- (b) Sketch and explain an Aux.Boiler automatic Combustion Control.
7. (a) The unit step response of a system is given as $c(t) = \frac{5}{2} + 5t - \frac{5}{2}e^{-2t}$. Find the transfer function of the system.
- (b) Draw the signal flow graph of following equation and find the transfer function. $\frac{dy^2}{dx^2} + \frac{2}{3} \frac{dy}{dx} + \frac{11}{2}y = x$
8. Plot the root locus pattern of a system whose forward path transfer function

$$G(s) = \frac{k}{s(s+2)(s+3)}$$
