Exam. Code: 0943
Sub. Code: 7065

1128
B.E. (Mechanical Engineering)
Seventh Semester
MEC-702: Automatic Controls

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. I (Section-A) which is compulsory and selecting two questions each from Section B-C. Calculator is allowed.

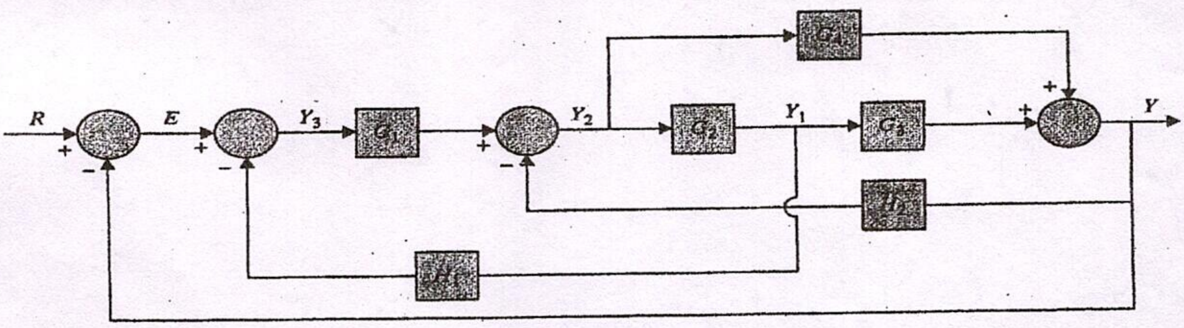
x-x-x

Part - A

1 a Define stability and locate stable and unstable system poles on s plane. 2
b What should be the value of K in the transfer function Y (s) R(s) = $16s^2$+Ks+16 given that the response of the system is critically damped? 2
c Explain why derivative action is not alone. State its one advantage and disadvantage. 2
d Find the transfer function of the system described by the following differential equation: $d^2y/dt^2 + 3dy/dt + 2y = 5$, with initial conditions $y(0) = 4$ and $dy/dt\ (0) = 3$ 2
e Differentiate between Regulators and servo mechanism. 2

Part - B

2 a Draw the block diagram of hydraulic Servo System. Explain function of each block. 5
b Explain the working of proportional controller. 5
3 a Explain Mason's gain formula with an example. 3
b Derive the transfer function of the block diagram by block reduction or signal flow graph. 7



4 a Compare PI, PD and PID controller. 5
b Explain the working of a temperature control system (Thermal control system). 5

Part – C

5 a For a unity feedback system, the open loop Transfer function is G(s) =4 /s^2 + 2s + 4, Determine i) Rise time, ii) Peak time, iii) Maximum overshoot and iv) Settling time. 7
b Find the condition for the stability of forward transfer function of a unity feedback system $G(s) = K(s^2 + 1)/(s + 1)(s + 2)$ 3
6 a Consider the system with characteristic equation is $P(s) = s^3 + s^2 + 2s + 2$. Determine stability of the system using Routh's criteria. 7
b The closed loop transfer function of a system is T(s) =$s^3 + 4s^2 + 8s + 16/s^5 + 3s^4 + 5s^2 + s + 3$. Calculate number of poles in the right half-plane and in left-half plane. 3
7 For the system with the state-space equations, derive an expression for transfer function between output and input 10

$$\begin{pmatrix} \dot{x}1 \\ \dot{x}2 \\ \dot{x}3 \end{pmatrix} = \begin{pmatrix} -4 & 1 & 1 \\ 0 & 0 & 1 \\ -1 & -4 & -2 \end{pmatrix} \begin{pmatrix} x1 \\ x2 \\ x3 \end{pmatrix} + \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \begin{pmatrix} u \end{pmatrix}$$

$$y = \begin{pmatrix} 1 & 0 & 0 \end{pmatrix} \begin{pmatrix} x1 \\ x2 \\ x3 \end{pmatrix}$$

x-x-x