Hall Ticket Number:

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VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (E.C.E.) III Year I-Semester (Main) Examinations, Nov./Dec.-2016

Automatic Control Systems

Time: **3** hours Max. Marks: **70**

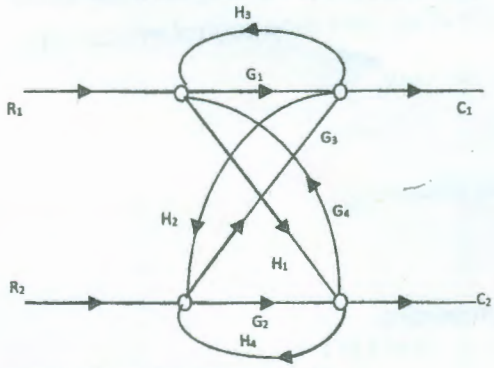
*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

1. Explain the elements of translational mechanical systems.
2. Write the merits and demerits of closed loop control system.
3. Characteristic equation of a system is $S(S^2 + 8S + 20) + K = 0$, find the value of gain 'K' such that the characteristic equation has a pair of roots on the vertical axis which passes through '-1'.
4. A unity feedback system with closed loop transfer function $\frac{C(s)}{R(s)} = \frac{ks+b}{s^2+as+b}$. Then find the steady state error with unit Ramp input.
5. The standard form of a second order system consists of resonant peak 1.3 and resonant frequency is 8 rad/sec, then determine its transfer function.
6. The open loop transfer function of a unity feedback system is $G(s) = \frac{k}{s(1+0.2s)(1+0.05s)}$ Determine the value of 'k' so that the gain margin is 20 dB.
7. Find the Z-transform of open loop transfer function $G(s) = \frac{10s}{(s+10)(s+2)}$ with sampling time of 2 secs.
8. List all the drawbacks of discrete data control system.
9. A system is characterised by equation $G(s) = \frac{S+2}{(S^3+3S^2+2S+10)}$. Find state and output equation of the system.
10. Explain the Kalman's test.

Part-B (5 × 10 = 50 Marks)

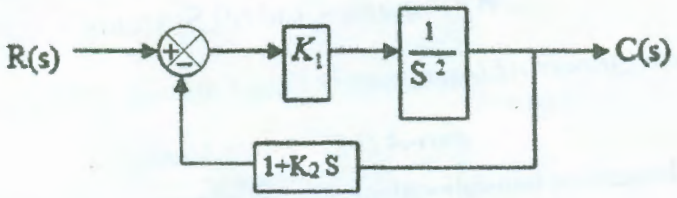
11. a) Following figure indicates the SFG of a certain system, find the output C_1 and also determine the condition that makes C_1 independent of R_2. [7]



b) What are the characteristics of servomotors? [3]

Contd...2

12. a) In the block diagram of a feedback control system shown below, determine K_1 and K_2 so that the maximum peak overshoot in unit step Response is 25% and the peak time is 2 seconds. [5]



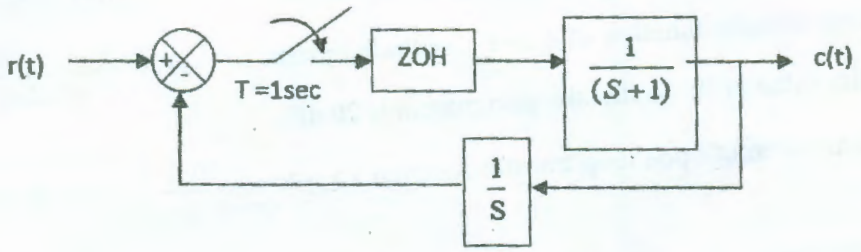
b) For a series RLC circuit with R=1 kΩ, L = 10 mH and C=0.01μF find the undamped natural frequency and Damping ratio of the circuit. [5]

13. a) Draw the Nyquist plot of a system with open loop transfer function $G(s)=\frac{K(s+1)^2}{s^3}$ [7]

b) From the above plot, find the number of right half of s-plane poles if K = 10. [3]

14. a) Explain the necessary steps for finding stability using Jury's Test. [3]

b) For the sampled data control system shown in figure below, find the output c(k) for r(t) = unit step. [7]



15. a) Obtain the state transition matrix of the system represented by the following state equation and using the same, determine the state transition equation for $t \geq 0$ [5]

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} r$$

The initial conditions are $x_1(0) = 1$ and $x_2(0) = -1$ & the input r (t) is the unit step function at $t \geq 0$.

b) Find whether the above system is controllable and observable or not. [5]

16. a) Sketch the Root Locus Diagram of an open loop control system $G(s)=\frac{k}{s(s+1)(s+2)}$. [7]

Determine closed loop system stability.

b) Explain Mason's gain formula. [3]

17. Write short notes on any *two* of the following:

a) PID controllers [5]

b) Sample data system [5]

c) State transition matrix (STM) properties. [5]

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