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SARDAR PATEL UNIVERSITY

M.Sc.(Electronics)III rd Semester Examination

(Under CBCS)

Friday 30th November,2012

Time : 02.30 p.m. to 05.30 p.m.

PS03CELE 01 : PRINCIPLES OF CONTROL SYSTEMS

NOTE: **Figures to the right indicate the maximum marks for the question.**

Total Marks: 70

Q:1 **Give the correct / nearest answer (statement) for the following multiple choice questions (statements).** **8X1=[8]**

1. The error signal in a Control System is
   (i) the difference between the measured value & the set value
   (ii) the sum of the measured value and the set value
   (iii) the ratio of measured value to set value
   (iv) Both (i) and (ii)

2. The motion of mechanical elements can be described as
   (i) purely rotational (ii) purely translational
   (iii) rotational or translational or combination of both
   (iv) none of these

3. The area under a unit-impulse function is
   (i) Infinity (ii) Unity (iii) Zero (iv) None of these

4. For a Second order over damped system, the poles are ____ and Damping ratio is _____
   (i) Real and equal (ii) Real and Unequal
   (iii) $0 < \xi < 1$ (iv) $1 < \xi < \infty$

5. The closed loop transfer function of a system is
   $C(S) / R(S) = (S - 4) / (S+2)(S+5)(S+7)$, the system is
   (i) Stable (ii) Unstable
   (iii) Marginally stable (iv) Conditionally stable

6. Asymptotes can intersect.
   (i) only on the negative real axis (ii) Positive real axis
   (iii) Imaginary axis (iv) any where on the real axis

7. The compensator placed in feed forward path is called
   (i) Output (or Load) compensation
   (ii) Cascade compensation
   (iii) Input compensation
   (iv) None of these

8. The concept of Nyquist plot is based on
   (i) Polar plot (ii) Bode plot
   (iii) Root locus (iv) Inverse Root locus

Q.2 **Give short answers to the following. (Any Seven)** **7X2=14**

1. Write classification of control systems. Give proper example wherever necessary.

2. Draw the complete signal flow graph for following system equations. Where Vi and Vo are the input and output of the system.
   V1 = 3Vi+2V2, **V2** = 2V1+6V3+3V2, **V3** = 6V2+Vo, **Vo** = 7V3

3. Summarize the effect of ξ on second order system performance.

4. Schematically show transient response specifications. Explain any two.

5. What is stability analysis of a system ? Examine the stability of equation $S^3 + 4S^2 + S + 16 = 0$ using Routh's method.

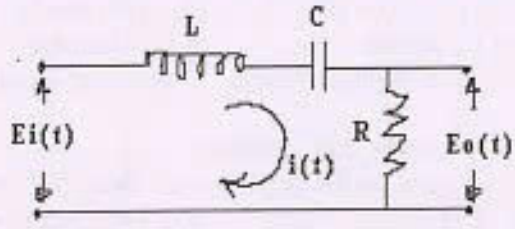
6. Write the effect of addition of open loop poles and zeros to the function G(S) H(S).

7. Define Gain Margin G.M and Phase Margin P.M. in context with the Bode plot.

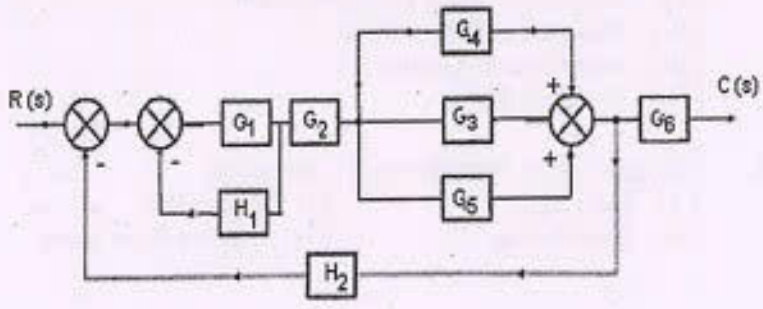
8. Explain the concept of an encirclement.

9. What is Compensation and Compensator ? Draw different types of Compensation schemes.

Q.3 (a) Define: Transfer function. Find out the Transfer function of the given network. **(6)**



(b) Reduce the following block diagram to its canonical form. **(6)**



OR

(b) Explain following terminology in context with the signal flow graph. (i) Source Node (ii) Sink Node (iii) Chain Node (iv) Forward path (v) Feedback loop (vi) self loop (vii) Path gain (viii) Dummy Node **(6)**

Q.4 (a) Discuss the effect of change in G(s) H(s) i.e Type of a system on steady state error for parabolic Input.. **(6)**

(b) Distinguish between Hysteresis Band and Proportional Band. Explain the three mode PID controller with proper schematics and waveforms. **(6)**

OR

(b) For unity feedback system having open loop transfer function $G(s) = K (S + 2) / S (S^3 + 7S^2 + 12 S)$ **(6)**
Find (i) Type of the system
(ii) Error coefficients
(iii) steady state error when input to the system is $R/2\ t^2$.

Q.5 (a) For Direct root locus if, **(6)**
$G(s)H(s) = K (S+10) / S (S+1) (S+2)$
Calculate angles of asymptotes and the centroid. Draw it.

(b) Define: Frequency response of a system. Derive an equation for a steady state Response to Sinusoidal input. What conclusion you can make from such Response ? **(6)**

OR

(b) Write the criteria of stability determination from polar plot. Which sections are used for Nyquist plot analysis ? Consider Type 1 system with open loop transfer function $G(s)H(s)= 1/s (1+Ts)$. Obtain its polar plot with respect to starting point and terminating point. **(6)**

Q.6 (a) Explain Hurwitz's and Routh criterion for stability analysis of the system. Determine the stability of characteristic equation $F(s) = S^3 + S^2 + S^1 + 4 = 0$ by Hurwitz's method. **(6)**

(b) Explain with proper circuit diagram the phase lag compensator network. Hence deduce an equation of transfer function. Draw its pole-zero plot. **(6)**

OR

(b) Sketch the inverse root locus for system having **(6)**
$G(s)H(s) = (S+4) / S (S^2 + 2S + 2)$