Q1: Choose the correct answer:

1) The eigen value of: $A=\begin{pmatrix} 0 & 1 \\ -16 & -10 \end{pmatrix}$, then determine if the system stable or unstable? [2 mark]

a) -2&-8& unstable b) -2&8& stable c) 2&8 & stable d) -2&-8 & stable

2) Test the controllability of the system described by the state equation: [2 mark]

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 3 & 0 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

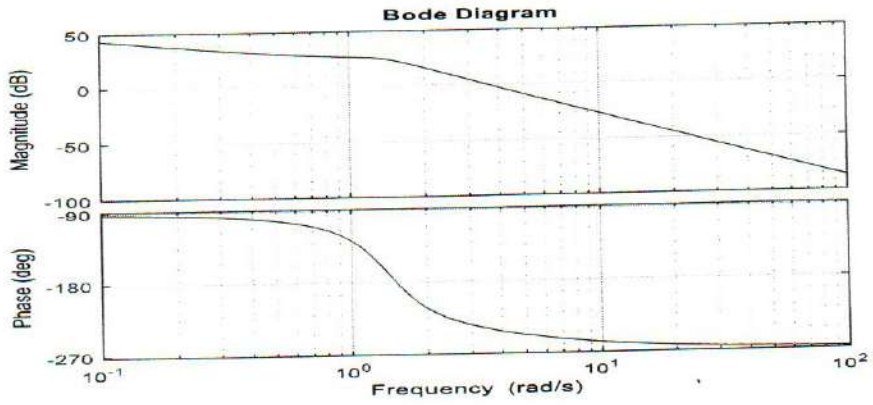
a) Controllable b) Not controllable

3) The magnitude of the basic factor which, is a straight line with slope of 20 dB/decade and crsossing the zero dB at w=1is: [1 mark]

a) 1/S b) S c) (s+1) d) 1/(s+1)

4) The gain margin crossover frequency from the foilowing figure are: [2 marks]

a)24dB & 61deg b) -24dB & - 61deg c) 24dB & -61deg d) -24dB & 61deg



5) From 4, the system is: [1 mark]

a) Stable b) unstable

6) Intersection of root locus branches with the imaginary axis may be determined by the use of:

a)Nyquist criterion b) Routh criterion c)Polar plot d) Bode plot [1 mark]

7) The break-away and break-in points on the root locus for the following open loop transfer function: $(s)H(s) = \frac{K(S+4)(S+5)}{(S+1)(S+2)}$, are: [3 marks]

a) -4.6& - 1.4 b) -4.42 &- 1.6 c) – 4.9& -1.1 d) -2.8& - 4.9

8) The angle of departure of the root locus from the pole(s= -2+j) for: $G(s)H(s) = \frac{K(S+3)}{S^2+4S+5}$, is:

a)-135 b) - 45 c)77.5 d)45 [3 marks]

9) The magnitude of, $G(s)H(s) = \frac{20(S+1)}{S(S+2)(S+3)}$, at the point -2+j3 is:

a) 1.849 b) 1.334 c) 2.548 d) 2.849 [2 marks]

10) Effect of adding a zero to transfer function is: [1 mark]

a) Pulling the root locus to the left b) Pulling the root locus to the right

11) The controller which increase the settling time and the overshoot is: [1 mark]

a) Proptional controller b) on/off controller
c) Integral controller d) derivative controller

12) The compensator which increasing the open loop gain without appreciably changing the transient response characteristics, is:

a) Lag compensator b) Lead compensator [1 mark]

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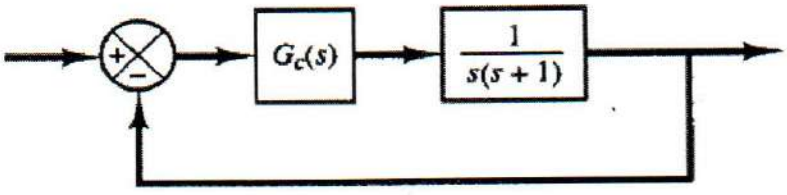
Q2: For the following system, Design a **Lag compensator** such that the static velocity error constant Kv= 50sec^{-1}, without changing in the original location (s= $-0.5 \pm j0.866$).



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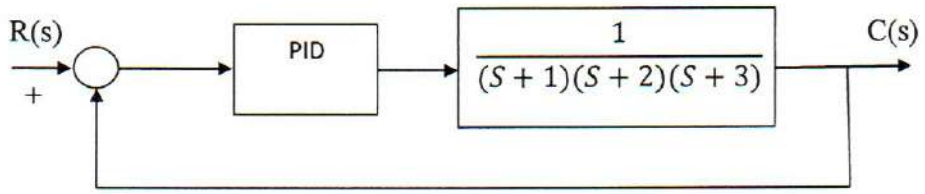
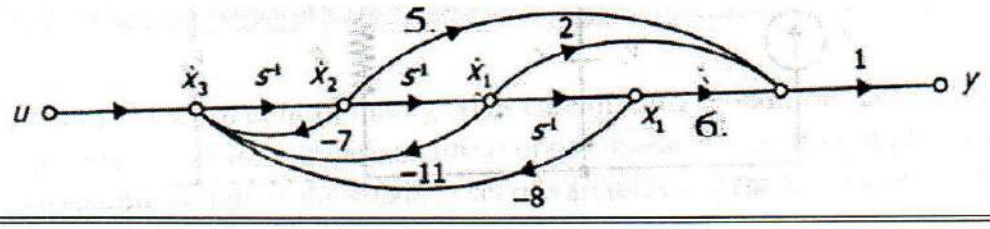
Q3:

a) Determine the Zeigler –Nichols tuning parameter for a PID controller, for the following system:

[6marks]



b) For the following system, Obtain state space representation in CCF. **[6marks]**



Good Luck