KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
ELECTRICAL ENGINEERING DEPARTMENT

EE380 [081]	SEC#_____	Quiz # 7
Name: Key	ID:_____	Grade:_____

1) **A system has the characteristic equation**

$$q(s) = s^3 + 4Ks^2 + (5+K)s + 10 = 0.$$

The range of *K* for a stable system is:

- ✓ ☒ $K>0.46$
- ☐ $K<0.46$
- ☐ $0<K<0.46$
- ☐ Unstable for all K

Routh Table:

s^3	1	$K+5$
s^2	$4K$	10
s^1	a	0
s^0	10	0

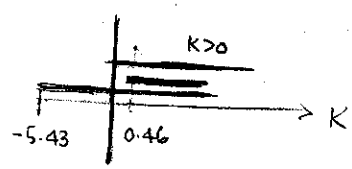
$$a = \frac{4K(K+5)-10}{4K} > 0$$

$$\therefore 4K^2 + 20K - 10 > 0$$

$$K^2 + 5K - 2.5 > 0$$

$$(K-0.46)(K+5.435) > 0$$

$$\therefore \boxed{K > 0.46}$$



2) **Utilizing the Routh-Hurwitz criterion, determine whether the following polynomials are stable or unstable:**

$$p_1(s) = s^2 + 10s + 5 = 0$$
$$p_2(s) = s^4 + s^3 + 5s^2 + 20s + 10 = 0.$$

- ☐ $p_1(s)$ is stable, $p2(s)$ is stable
- ☐ $p_1(s)$ is unstable, $p2(s)$ is unstable
- ☐ $p_1(s)$ is unstable, $p2(s)$ is stable
- ✓ ● $p_1(s)$ is stable, $p2(s)$ is unstable

$P_1(s) = s^2 + 10s + 5$

s^2	1	5
s^1	10	0
s^0	5	

$\Rightarrow$ $P_1(s)$ is stable

$P_2(s) = s^4 + s^3 + 5s^2 + 20s + 10$

s^4	1	5	10
s^3	1	20	0
s^2	-15	10	
s^1	$+\frac{310}{15}$	0	
s^0	10		

2 sign change

$\Rightarrow$ $P_2(s)$ is unstable

3) **A marginally stable system has poles on the *jw*-axis.**

- [x] True
- [ ] False

4) **A system is stable if all poles lie in the right half-plane.**

- [ ] True
- [x] False

5) **The Routh-Hurwitz criterion is a necessary and sufficient criterion for determining the stability of linear systems.**

- [x] True
- [ ] False