**Indian Institute of Information Technology, Allahabad**

**Department of Electronics and Communication Engineering**

*Course Name: Control System Lab*

**EXPERIMENT NO: 5**

**DETERMINATION OF Nyquist PLOT USING MATLAB CONTROL SYSTEM TOOLBOX FOR 2ND ORDER SYSTEM & Comment On Stability.**

**Objective:** Draw Nyquist Plot of a system having forward path transfer function is $t_1$ .

$$t_1 = \frac{10}{s^2 + 4s + 7}$$

**Materials Required:** MATLAB Software.

**Gain Cross over frequency:** The frequency at which gain of the open loop system is unity.

**Phase cross over frequency:** The frequency at which phase of the open loop system is -180$^0$.

**Gain margin:** Gain margin is defined as the amount of change in open-loop gain needed to make a closed-loop system unstable. The gain margin is the difference between 0 dB and the gain at the phase cross-over frequency .

**Phase margin:** Phase margin is defined as the amount of change in open-loop phase needed to make a closed-loop system unstable. The phase margin is the difference in phase between −180° and the phase at the gain cross-over frequency

**Stability: GM and PM both are +Ve ---------------------- system stable**

**GM and PM both are 0 ------------------------- marginal stable**

**Otherwise -------------------------------------------unstable**

**MATLAB Code :**

```
clc;
clear all;
close all;
n1=[10];
d1=[1 4 7];
t1=tf(n1,d1) % transfer function
nyquist(t1,'r')
grid on
% to find system stability
 margin(t1)
[gm, pm, wcp, wcg] = margin(t1)
gmdb = 20*log10 (gm)
if ((pm>0) & (gmdb>0))
disp ('THE SYSTEM IS STABLE')
else
if ((pm==0) & (gmdb==0))
disp ('THE SYSTEM IS MARGINALLY STABLE')
else
disp ('THE SYSTEM IS UNSTABLE')
end
end
```

**Result:**

```
gm =

   Inf


pm =

   94.5252


wcp =

   Inf


wcg =

    2.4922


gmdb =

   Inf

THE SYSTEM IS STABLE
```



Nyquist Diagram