(6) Given Transfer function is

$$TF = \frac{K}{(S+1)(S+2)(S+3)}$$

Poles of the Given transfer function are $-1, -2, -3$ and there are no. zeroes, hence $p=3$ and $z=0$

Centroid of Asymptotes, $\rightarrow \alpha = \frac{-1-2-3}{3-0} = \frac{-6}{3} = \boxed{-2}$ //

Angles of Asymptotes $\phi = \left(\frac{2q+1}{3-0}\right) \times 180^\circ$

if $q=0$, $\phi_1 = 60^\circ$

$q=1$, $\phi_2 = 180^\circ$

$q=2$, $\phi_3 = 300^\circ$

if $q \geq 2$, angles will repeat again

There are No. angle of departure (or) angle of Arrival because of absence of Complex zeroes and Complex poles,

for finding Break in and Breakaway points,

we use characteristic Equation,

$$1 + \frac{K}{(S+1)(S+2)(S+3)} = 0 \Rightarrow K = -(S+1)(S+2)(S+3)$$ ii

Now, we have, $K = -(S^3 + 7S^2 + 11S + 6)$

$$\frac{dK}{dS} = 0 \Rightarrow -(3S^2 + 14S + 11) = 0$$

$$\Rightarrow \boxed{3S^2 + 14S + 11 = 0} \rightarrow -3.67, -1 \} \text{Two roots}$$

Now if we use and draw the root locus graph,

jω
Argand plane.
A1
180°
Break away point
P2
60°
60°
-3
-2
-1
σ
root locus Exists
Centroid of Asymptotes
root locus exists
A3
Stable region.
Unstable region
At larger values of K, System becomes unstable Because it moves to unstable region.