ASSIGNMENT 1

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Download all latex-tikz codes from

https://github.com/AI20BTECH11014/EE3900-Linear-Systems-and-Signal-processing/blob/main/ASSIGNMENT%201/ASSIGNMENT_1.tex

1 Vectors 2.16

A fighter plane flying horizontally at an altitude of 1.5 km with speed 720 km/h passes directly overhead an anti-aircraft gun. At what angle from the vertical should the gun be fired for the shell with muzzle speed 600 m/s to hit the plane ? At what minimum altitude should the pilot fly the plane to avoid being hit ? (Take $g = 10ms^{-2}$).

2 Solution

Given,Speed of the fighter plane v=720km/h=200 m/s, Muzzle velocity of the gun u=600 m/s.
Let 'θ' be the angle with the vertical so that the shell hits the plane and 't' be the time taken by the shell to hit the plane.
As shell hits the plane,

$$usin\theta \times t = v \times t \tag{2.0.1}$$
$$sin\theta = \frac{v}{u} \tag{2.0.2}$$
$$sin\theta = \frac{200}{600} \tag{2.0.3}$$
$$sin\theta = \frac{1}{3} \tag{2.0.4}$$
$$\theta = 19.50^\circ \tag{2.0.5}$$

In order to avoid being hit by the shell, the pilot must fly the plane at an altitude (H) higher than the maximum height achieved by the shell for any angle of launch.

$$H_{max} = \frac{u^2}{2g} \tag{2.0.6}$$
$$H_{max} = \frac{600^2}{20} \tag{2.0.7}$$
$$H_{max} = 16km \tag{2.0.8}$$
$$\therefore H = 16km \tag{2.0.9}$$