

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

maximum height achieved by the shell for any angle of launch.

$$H_{max} = \frac{u^2}{2g} \quad (2.0.6)$$

$$H_{max} = \frac{600^2}{20} \quad (2.0.7)$$

$$H_{max} = 16km \quad (2.0.8)$$

$$\therefore H = 16km \quad (2.0.9)$$

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,

$$u \sin \theta \times t = v \times t \quad (2.0.1)$$

$$\sin \theta = \frac{v}{u} \quad (2.0.2)$$

$$\sin \theta = \frac{200}{600} \quad (2.0.3)$$

$$\sin \theta = \frac{1}{3} \quad (2.0.4)$$

$$\theta = 19.50^\circ \quad (2.0.5)$$

In order to avoid being hit by the shell, the pilot must fly the plane at an altitude (H) higher than the