Unit 1: Crosstalk between Biology & Engineering

It is an interdisciplinary field where principles and techniques from both disciplines (विधाएं) are integrated (work-together) to solve complex problems.

Biologically inspired technologies:-

Engineers frequently draw inspiration from biological systems to design new technologies.

For Example:-

i.) Aeroplane design inspired by Birds.
ii) Bullet Train design inspired by the beak of the Kingfisher bird.
iii) Velcro tape inspired by burr fruit.
iv) Shark skin-inspired surface etc

Def^{n} Biomimetics or Biomimicry (Nature ↗, exhibiting mimicry ↙): - Biomimetics or Biomimicry is the imitation (or copy) of the nature's models and use them for the purpose of solving complex human problems.

In short, Engineers draw inspiration from biology for design.

(2) Case study :- A case study is an in-depth, detailed examination of a particular case (or cases) within a real world content.

1.) Aeroplane Design inspired by Birds

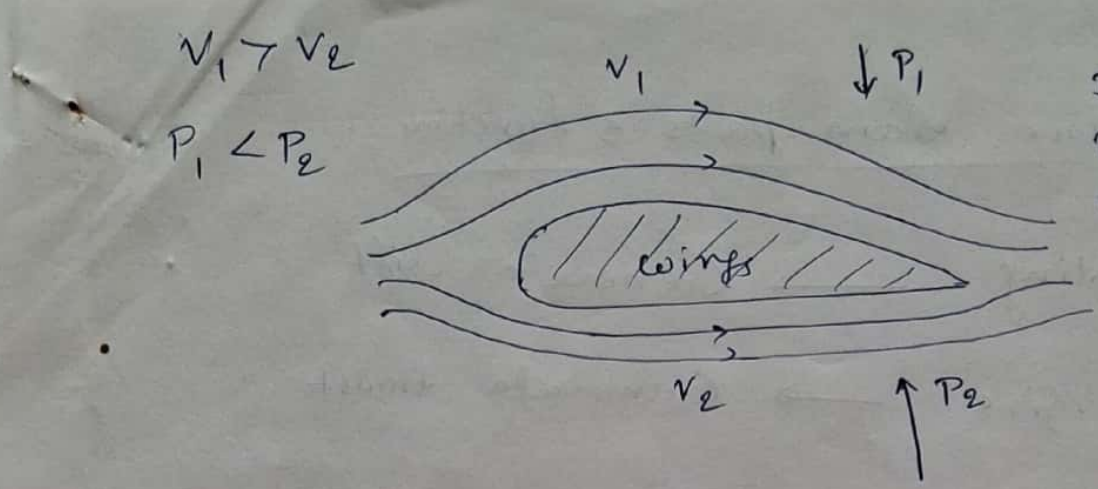
Inspiration :- A long time ago, people wanted to fly like bird. So they watches birds closely to learn their secrets.

Problem :- A long time ago, humans wanted to build something that could fly like bird, but it was really hard. Machines they made did not fly well or at all.

Solution :- Engineers carefully watched birds and learned some important things:

1) Right shape :- shape of the birds wings help them to lift off and move through the air smoothly.

Engineers used this idea to design airplane wings that are curved to create lift.



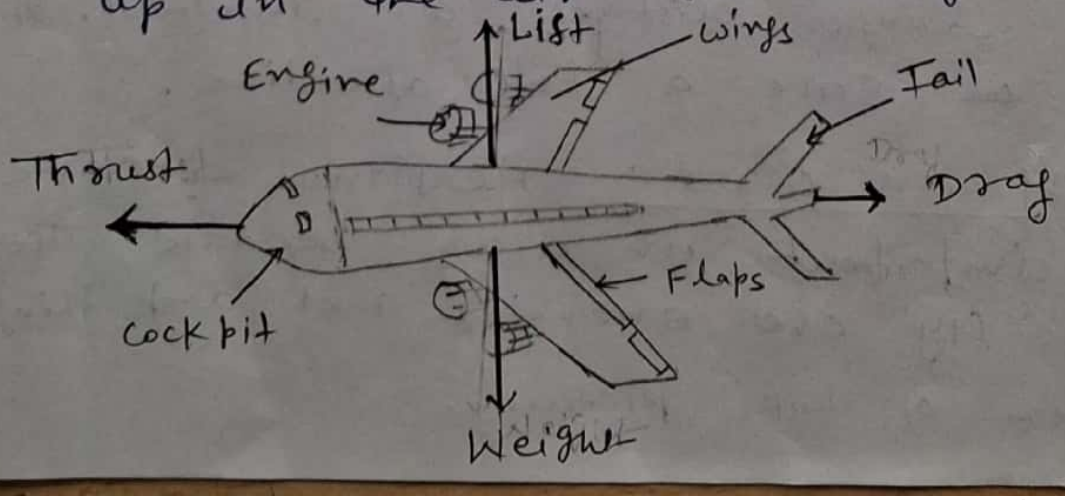
Due to Pressure difference airplane lift up

ii) Moving Parts :- Birds have feathers they can move and control the direction and also stay balanced.

Engineers put similar moving parts on airplanes, like flaps and a tail, to help pilots so that they control the plane.

iii) Powerful Engines :- Birds use their muscles to fly, whereas airplanes use engines to fly.

Engineers built powerful engines to push airplanes forward, helping them stay up in the air for long distance.



(4)

Airplane Main parts & function

Wing ⟶ Generate lift

Engine ⟶ Generate thrust

Flaps ⟶ Increase lift and Drag

Tail ⟶ Stabilize the plane

Flight condition	Effect
Lift > weight	Plane Rises
weight > Lift	Plane falls
Drag > Thrust	Plane slows
Thrust > Drag	Plane accelerate

Impact (Benefits) :-

i) **Travel Revolution :-** The biggest advantage of flying is that it is the fastest way to go from one place to another, especially when longer distance are involved. It helps us save a lot of time.

ii) **Helping in wars :-** Airplanes became very important in wars because they could fly over enemies and drop things on them or take pictures.

Legacy (or Conclusion):-

By watching birds, humans figured out (understand) how to make machines that could fly. It is a ~~grate~~ great example of how nature can inspire us to solve big problems and create amazing things.