Dt. 21/2/2022 [120BM0014] ①

BIOMECHANICS

MID-SEM

Q1) Study of biological systems or body parts and their function using the concepts of mechanics. It studies the concept of motion in bodies using the knowledge of mechanics. Biomechanics is generally used to study the general locomotion of the human beings, motion of birds or streamline movement of fish.

If we talk about human movement, biomechanics is heavily used to study athlete movements, used to study the most effective posture or less fatigue exercise in order to get more productivity and less injury. Tracking the centre of mass helps handle load during training. So, the understanding of motion of biological parts helps us protect it too.

Q2) Yes, this statement is pretty true. The tails of big cats like tiger or cheetah do play a role is maintaining balance during sharp turns in pursuit of prey. During their sprint they have to readily move in a zig-zag manner, manoeuvering skillfully. During sharp turns, their centre of gravity may fall out of the body and hence they crash but the strong muscle of the tail and especially the muscle at the end of the tail which is thrown in the other direction helps to counter balance the inertia.

The thick long tail of tiger which is 3 ft approx in length does not swiftly move in air but remain in the inertial position. These mini-balances help in counter-balance and help tiger take sharp turns.

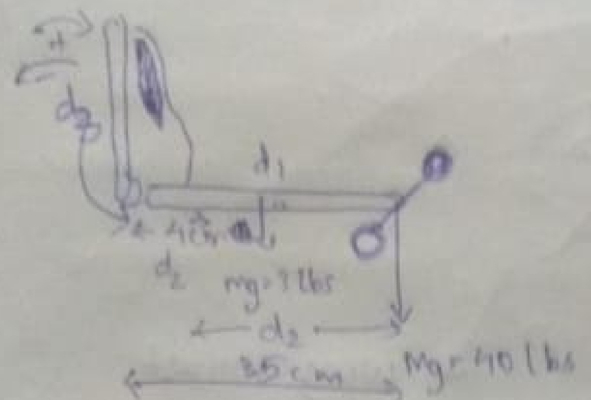
Q4) *) Virtual work is the total work done by the inertial forces and applied forces in a mechanical system which undergoes virtual displacement. When the body is in static equilibrium, the principle of least action needs all virtual work to be zero.

*) This is generally used in systems where the parts are inter-connected or can move with respect to each other. This is used in multiaxial systems. It helps us to determine stability of systems in equilibrium

$$\boxed{\delta U = \vec{R} \cdot \delta \vec{r}}$$

Virtual work does not really exist but we assume them so as to check various other equilibrium positions to know which is more stable.

Q5)



$$\sum T_1 = 0$$

$$0 = (Mg)d_1 + (mg)d_2 - Fd_3$$

$$\Rightarrow F = \frac{Mg\,d_1 + mg\,d_2}{d_3}$$

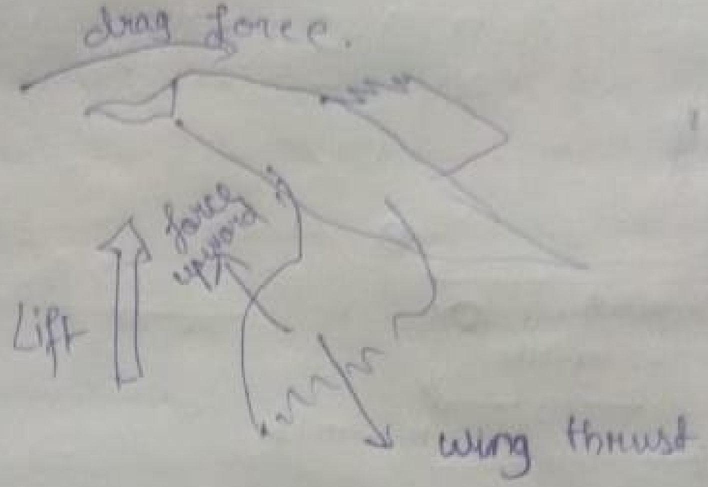
$$\Rightarrow F = \frac{(40\ lbs)(35\ cm) + (9\ lbs)(17.5\ cm)}{4\ cm} \Rightarrow F = \frac{1452.5}{4}\ lbs$$

$$\Rightarrow \cancel{\boxed{F = 363.125\ lbs}} \Rightarrow \boxed{F = 363.125\ lbs}$$

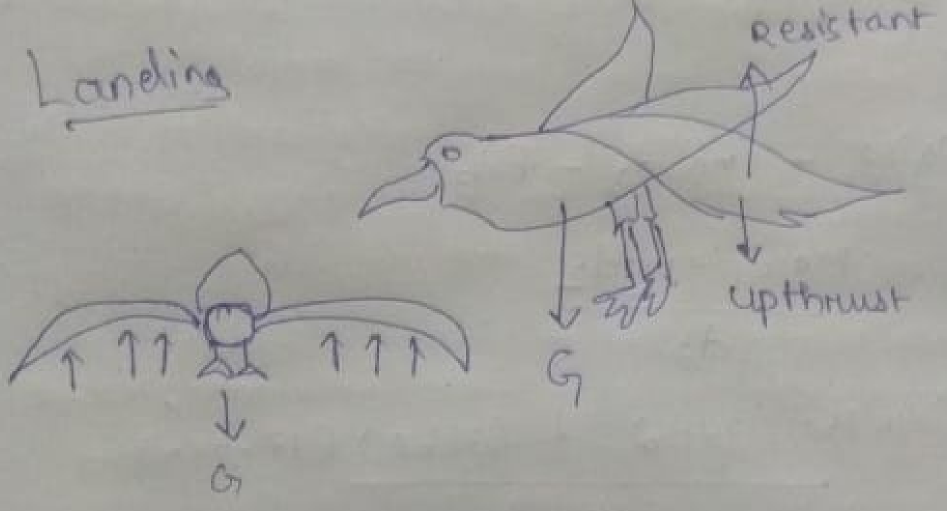
Q3) Landing

During landing the buoyancy thrust upwards and airdrag along with the gravity of the body of the albatross decide the landing. If the air is brisk the landing becomes more easy. Their webbed feets are used as hydroplanes. If there is no wind, then the bird has to come down at a greater speed and depend upon their feet to do the necessary braking. They need the air other wise with such high speeds they may come crashing down and break bones.

Taking off



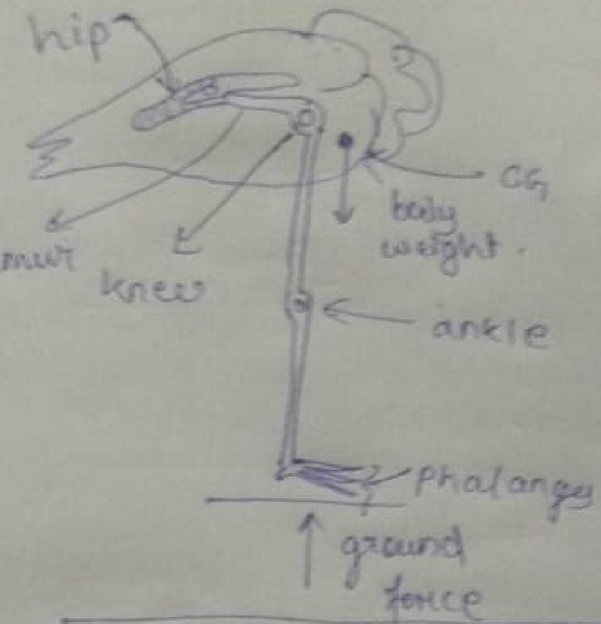
Landing



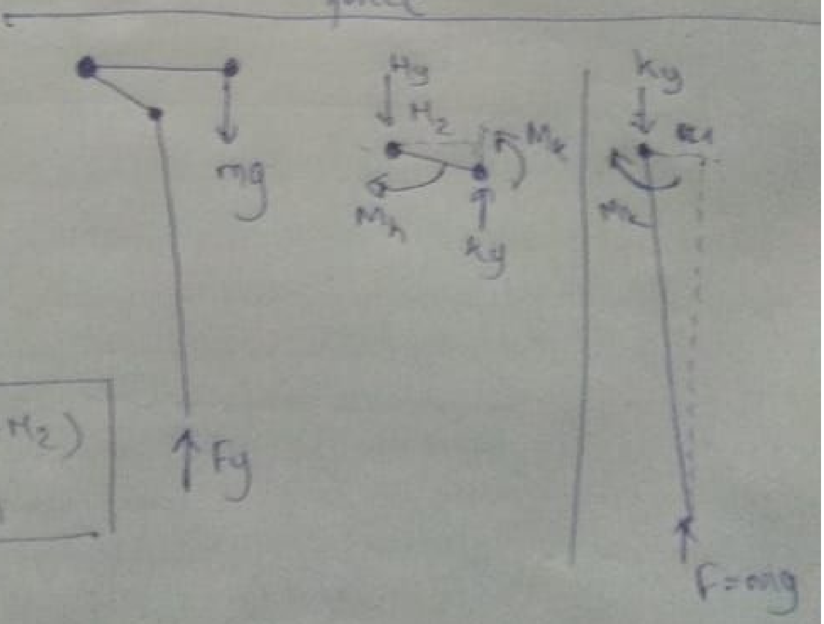
Taking off

During taking off it uses like a long runway. They run into the headwind and stronger winds helps in greater lift. It generally launch off from the cliff edge if the wind is blowing towards it. It uses dynamic soaring. So, they lock their wings in the gliding positions hence spend less energy to fly.

(6) Flamingos can stang on one leg for more time rather than 2 legs as it reduces its fatigue. The flaming actually has the knee near to its body. This also helps in preserving body heat as they shed a lot of heat.



So,



So, $\boxed{\begin{aligned} M_h &= mg(H_1+H_2) \\ M_k &= mg\,H_1 \end{aligned}}$

The interlocking and the balance of the centre of gravity and the leg makes it possible for flamingo to stand still on one leg without the help of muscles and without fatigue in resting position.