



TRINITY COLLEGE FOR WOMEN NAMAKKAL

Department of Mathematics

STATICS

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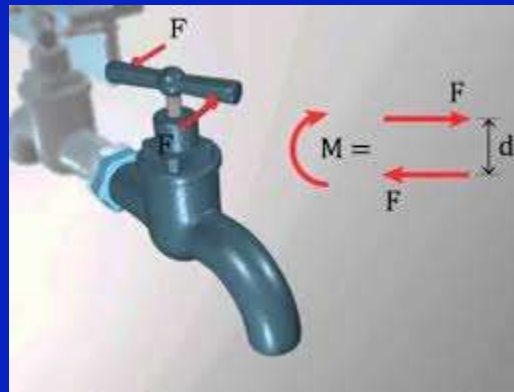
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COUPLES

Definition:

Two equal and unlike Parallel forces not acting at the same point are said to constitute a couple.

Examples:



Moment of the couple:

The moment of a couple is the product of either of the two forces of the couple and the perpendicular distance between them.

Arm of the couple:

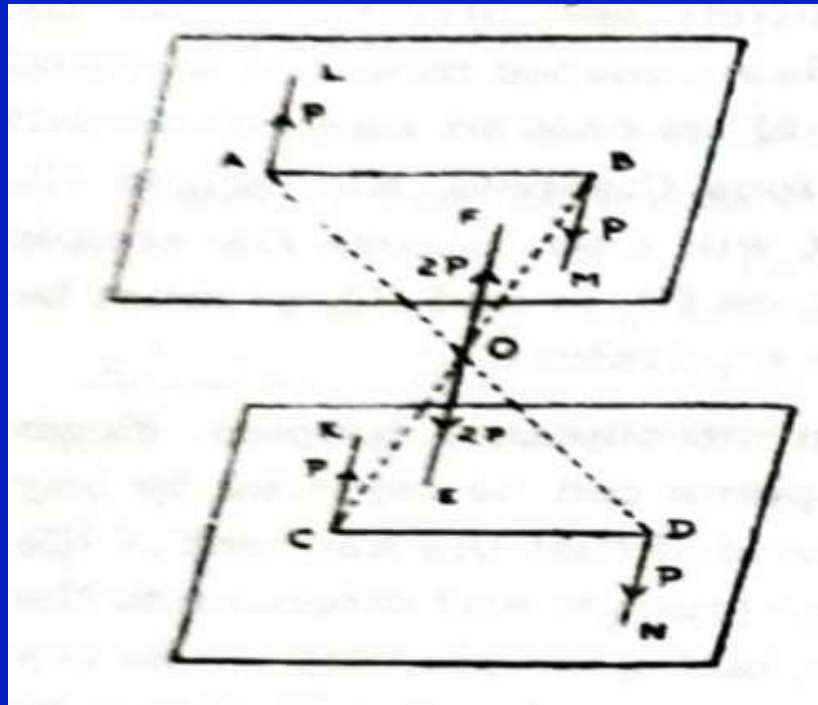
The perpendicular distance $AB=p$ between the two equal forces P of a couple is called the arm of the couple.

Note:

A couple each of whose forces is P and whose arm is p , denoted by (P,p) .

Couples in Parallel Planes

The effect of a couple upon a rigid body is not altered if it is transferred to a parallel plane provided its moment remains unchanged in magnitude and direction.



Proof:

Consider a couple of forces P at the ends of arm AB in a given plane.

Let AL and BM be the lines of action of forces.

In any parallel plane, take a straight line CD equal and parallel to AB

then $ABCD$ will be Parallelogram. The diagonals AD and BC will bisect each other at O .

At O, introduce two equal and opposite forces of magnitude $2P$ along EF, parallel to the forces P at A and B.

By this, the effect of the given couple is not altered.

Now, the unlike parallel forces P along AL and $2P$ along OE can be compounded into a single force P acting at D.

Since

$$\begin{aligned} AD/OD &= 2/1 \\ &= 2P/P \end{aligned}$$

This resultant force P acts along DN in the second plane.

Similarly, the unlike parallel forces P along BM and $2P$ along OF can be compounded into a single force P acting at C along CK .

Therefore, we have a couple of forces P at the ends of the arm CD in a plane parallel to that of the original couple.

Thus, the given couple with the arm AB is equivalent to another couple of the same moment in a parallel plane, having its arm CD equal and parallel to AB.

Hence, a couple in any plane can be replaced by another couple acting in a parallel plane, provided that the moments of the two couple are same in magnitude and sign.

Note:

A couple in a plane can be replaced by any other couple in the same plane.

The only important criterion is that the moment of the new couple must be equal to that of the first couple in magnitude and sense.

Thus a couple (P, p) may be replaced by a couple $(F, Pp/F)$ in the same sense.

$$\begin{aligned} \text{The moment of the new couple} &= F \cdot Pp/F \\ &= Pp \end{aligned}$$

=moment of the first couple

Therefore,

The moment of the new couple = Moment of the first couple.

THANK YOU

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