ENGR14 - STATICS TUE 01-05-16

FORCE WEEK

WHAT'S STATICS? (CHAPTER 1.1 - 1.5)

1.1 MECHANICS

↳ SOLID MECHANICS ↳ FLUID MECHANICS

↳ DEFORMABLE BODIES → ME80

↳ RIGID BODIES

↳ DYNAMICS → ENGR15

↳ $\boxed{\text{STATICS}}$ → ENGR14

1.2 CONCEPTS METRIC / SI UNITS

↳ LENGTH	METER m	SCALAR
↳ TIME	SECOND s	SCALAR
↳ MASS	(KILO) GRAM (K)g	SCALAR
↳ FORCE	NEWTONS N	VECTOR

IDEALIZATIONS

↳ "PARTICLE"... HAS MASS BUT NO SIZE (depend on view, e.g. earth as particle in context of planet motion)

↳ "RIGID BODY"... GROUP OF PARTICLES WITH A FIXED DISTANCE

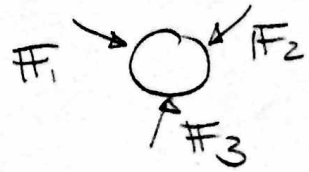
↳ "CONCENTRATED FORCE"... REPRESENTATION OF LOADING (OVER A SMALL AREA) AS A SINGLE FORCE

NEWTON'S THREE LAWS OF MOTION

I. A PARTICLE MOVING AT A CONSTANT VELOCITY (SPECIAL CASE: REST WITH NO VELOCITY), v = const REMAINS ON THIS STATE UNLESS IT IS

SUBJECT TO an UNBALANCE FORCE

1D "EQUILIBRIUM"

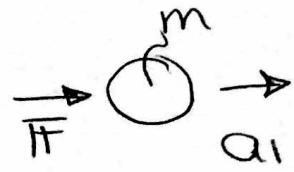


$\boxed{\Sigma F = 0}$

$\boxed{v = \text{const}}$

II. A PARTICLE OF MASS m SUBJECT TO a FORCE F EXPERIENCES an ACCELERATION a LONG THE LINE OF F SUCH THAT

1D "ACCELERATED MOTION"

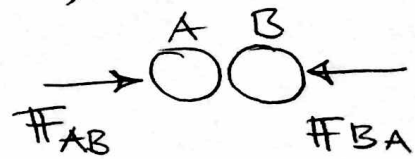


$a = F/m$

$\boxed{F = m\,a}$

III. MUTUAL FORCES OF ACTION & REACTION ARE EQUAL, OPPOSITE, and COLLINEAR

1D "ACTIO = REACTIO"



$\boxed{F_{AB} = -F_{BA}}$

WEIGHT ("conversion of mass into force")

$\boxed{W = m\,g}$

W... weight

m... mass

$g = 9.81 \frac{m}{s^2}$

g... acceleration due to gravity

↳ THE BODY OF a mass OF m = 1 kg HAS A WEIGHT OF $W = 1\,kg \cdot 9.81 \frac{m}{s^2} = 9.81\,N$

1.3/1.4 SI SYSTEM OF UNITS

10^9 = giga - G
10^6 - mega - M
10^3 - kilo - k
10^{-3} - milli - m
10^{-6} - micro - μ
10^{-9} - nano - n

CONVERSION

	FPS	SI
FORCE	lp	4.448 N
MASS	slug	14.59 kg
LENGTH	ft	0.305 m