unacademy

CIVIL ENGINEERING

CLASS NOTES

STRUCTURAL ANALYSIS

(For all Competitive Exams in INDIA)

VIVEK GUPTA

VIVEK GUPTA

ESE (AIR-10)
GATE (AIR-17)
M. Tech (IIT Delhi, Structure)

This is the class notes of course taught on UNACADEMY PLUS during 05.01.2022 to 25.02.2022 in 80 hours. This course will be very helpful for all students who are preparing for any competitive examination in India.

WhatsApp: 9650681684 (Reply frequency 24 Hours)
(Please don't call without taking time to call)

A

very special thanks

to all those students who attended this course and suggested well to make this class notes a perfect piece.

Few lovable students who contributed are

Ashish, Aman, Aparup, Apoorva, Aniket, Jhanvi, MANISH KUMAR, Mohammad, TARUN, Akanksha, Nithin, Unstoppable (KESHAV KUMAR), Mahendra, Anshul, Bhawesh, Mayank, Spandan, Shankar, Aparup, Ravi Shankar, Shashthi, SPANDAN, sunil, RAJESH KUMAR, Aditya Prakash, Braj Raj Singh.

A very special Thanks to SUMAN MANOCHA sir (Superintending Engineer, Govt. of Rajasthan) who also attended this course and suggested well for betterment of this class notes.

(All names mentioned here are with consent of Individuals)

CONTENTS

unacademy

CHAPTER – 1
BASIC CONCEPTS

Recommended Literatures.

1. My Class Notes.
2. R.C. Hibbeler, 9th Edition, SI Unit.
3. My WorkBook.
4. PYQs of GATE & ESE

1.1. Introduction.

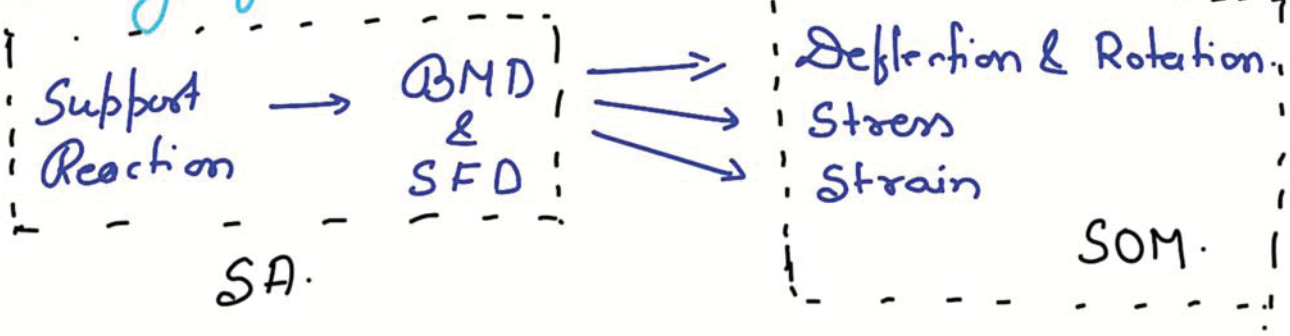
Structural Engineering.

- Analysis (SOM, SA)
  - Equilibrium
  - Compatibility.
  - Energy.
- Design. (RCC, STEEL, PSC)
  - Safety
  - Serviceability.
  - Durability.
  - Economy.
  - Aesthetic.

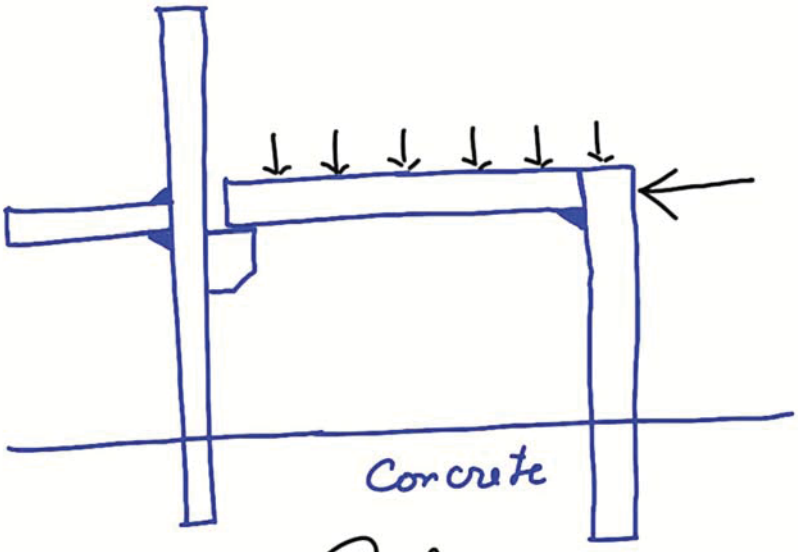
1.2. What is Structure?.

Any arrangement of members that can transfer load acting upon it to the supports safely can be termed as structure.

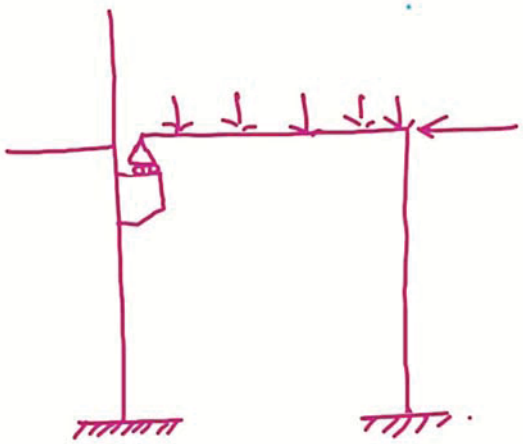
1.3. Meaning of Structural Analysis



1.4. Idealisation of Structure.



Real.



Idealised.

R.C. Hibbeler

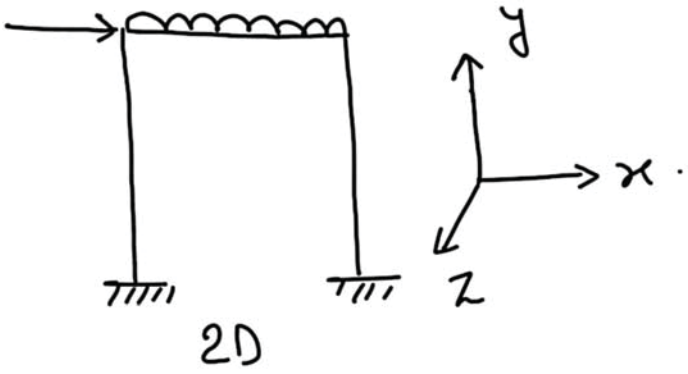
Page No — 40.

Fig - 2.5.

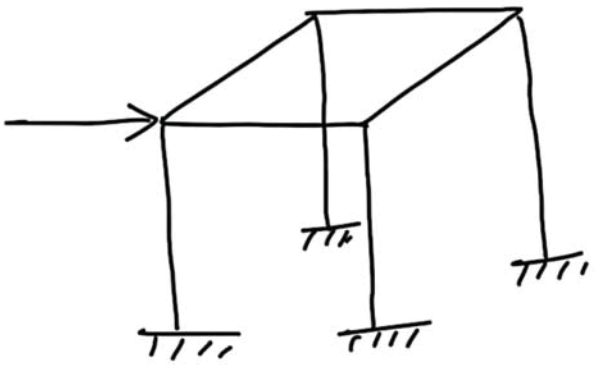
1.5 2D & 3D Structure.

If 2-axes are sufficient to define geometry and loading of structure then that type of structure is called 2D structure.

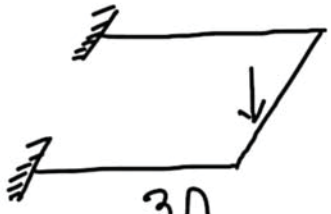
If 3-axes are required to define geometry and loading of structure then that type of structure is called 3D structure.



2D

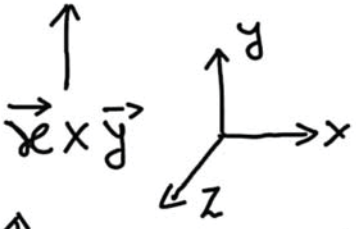


3D.



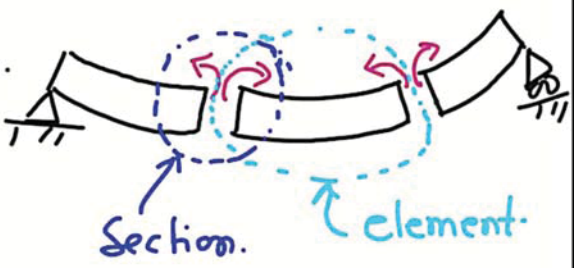
3D

1.6 Sign Convention.

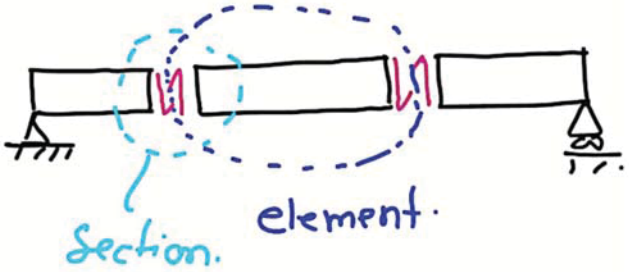
Items.	(+ve) Sign.
x- axis	
y-axis	
z-axis.	
Slope $\left(\frac{dy}{dx}\right)$	 anticlockwise.
Rotation	clockwise.
Force	along axis.
Moment	Clockwise.

Axial force — Tension. (Scalar).

Bending Moment. — Sagging.



Shear force —

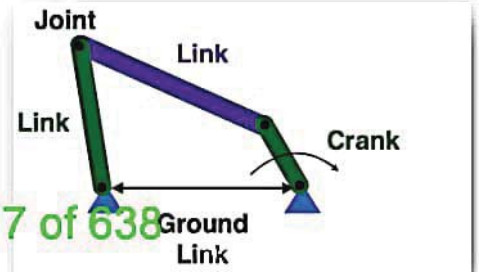


1.7. Types of support.

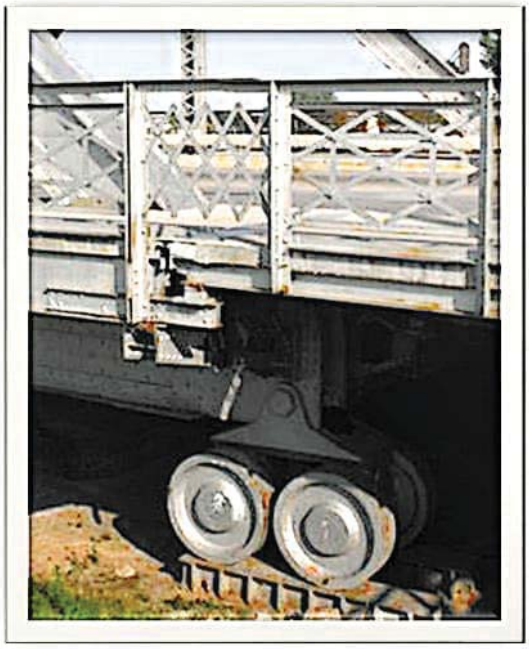
Any arrangement that can restrict movement of any point of a structure is called as support.

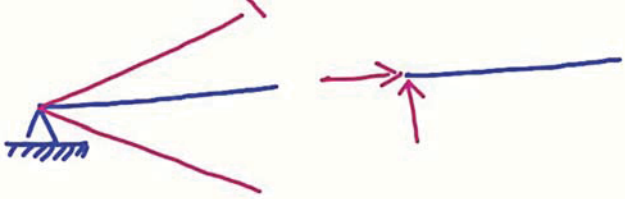
Reaction at support is always due to restriction of movement so direction of reaction is always in opposite direction to expected movement.

Hinge support

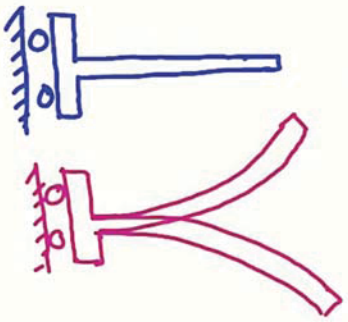


Roller Support



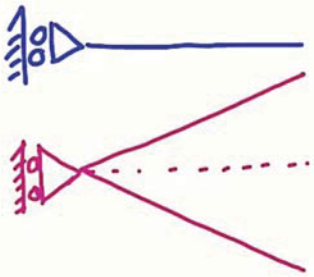
Movement Restricted	Representation	Reaction	Remarks.
x, y, rotation			Fixed
x, y			Pin., Hinge
y, rotation.			Guided roller.

rotation, x



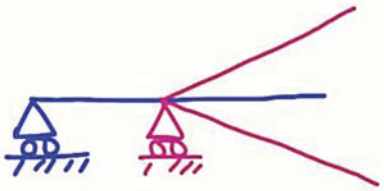
Guided roller.

x



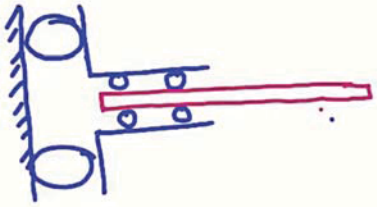
Roller

y.



Roller.

rotation



R.C. Hibbeler.

Page No. 36. Fig 2.2, 2.3.

39. Table 2.1.