IES MASTER

Civil Engineering

Toppers Handwritten Notes

DESIGN OF STEEL STRUCTURES

- Theory
- Explanation
- Derivation
- Example
- Shortcuts
- Previous Years Question With Solution

BY-GHANSHYAM SIR

HindPhotostat

GET IT ON Google Play

MADE EASY , IES MASTER , ACE ACADEMY , KREATRYX

ESE , GATE, PSU BEST QUALITY TOPPER HAND WRITTEN NOTES
MINIMUM PRICE AVAILABLE @ OUR WEBSITE

1. ELECTRONICS ENGINEERING
2. ELECTRICAL ENGINEERING
3. MECHANICAL ENGINEERING
4. CIVIL ENGINEERING
5. INSTRUMENTION ENGINEERING
6. COMPUTER SCIENCE

IES ,GATE , PSU TEST SERIES AVAILABLE @ OUR WEBSITE

- IES –PRELIMS & MAINS
- GATE

➢ NOTE;- ALL ENGINEERING BRANCHS

➢ ALL PSUs PREVIOUS YEAR QUESTION PAPER @ OUR WEBSITE

PUBLICATIONS BOOKS -

MADE EASY , IES MASTER ,ACE ACADEMY ,KREATRYX ,GATE ACADEMY, ARIHANT ,GK

RAKESH YADAV, KD CAMPUS , FOUNDATION , MC –GRAW HILL (TMH) ,PEARSON...OTHERS

HEAVY DISCOUNTS BOOKS AVAILABLE @ OUR WEBSITE

F230, Lado Sarai New Delhi-110030 Phone: 9311 989 030	Shop No: 46 100 Futa M.G. Rd Near Made Easy Ghitorni, New Delhi-30 Phone:9711475393	F518 Near Kali Maa Mandir Lado Sarai New Delhi-110030 Phone: 9560 163 471	Shop No.7/8 Saidulajab Market Neb Sarai More, Saket, New Delhi-30

Website: www.hindPhotostat.com

Contact Us: 9311 989 030

Courier Facility All Over India

(DTDC & INDIA POST)

Steel Structure

ESE
- Pre → 5-6 Q. (12-13 Q in 2021).
- Mains → 60 Marks.

GATE → 2-3 Q.

Content

1. Introduction

Purpose of Is codes.

① To ensure minimum safety.
② Legal validity.
③ Consistency among designers.
④ Certain tables and graphs for easier calculation.

Important codes for design of steel str.:

① IS: 800 - 2007 : Design of steel structure.
② steel table. → IS: 808

Difference between RCC & steel structure:

Reinforced cement concrete structures	steel structure
① RCC materials can not be reused.	① steel can be re-used
② RCC has less strength to wt ratio.	② steel has more strength to wt ratio
③ Less costly	③ More costly
④ section size required is more hence heavy wt structure.	④ section size required is less hence light wt structure.
⑤ Less ductile	⑤ more ductile
⑥ Non-homogeneous hence not easy to pridict the behaviour	⑥ Homogeneous hence easy to predict the behaviour.
⑦ More fire resistant	⑦ less fire resistant
⑧ Negligible corrosion.	⑧ Corrosion is more

Steel

It is an alloy of iron having carbon content 0.1 to 1.1%

- Based on carbon content, there are three types of structural steel.
  - (I) Low carbon steel (0.1 – 0.25 % carbon) → as structural steel.
  - (II) Medium carbon steel (0.2 – 0.6% carbon)
  - (III) High carbon steel. (0.6 – 1.1 % carbon).

Wrought Iron. (Purest). → C ≤ 0.2%

steel

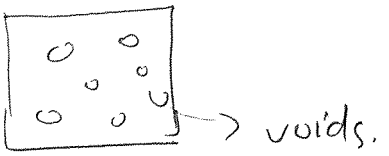
Cast Iron. ⟶ C ≥ 2.5%

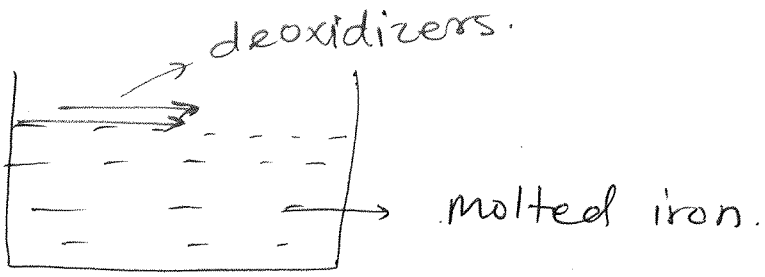
- % carbon ↑ ⇒ ductility ↓
- Also % carbon ↑ will be bad effect in welding.

Deoxidizers such as silicon or Aluminium are used to control dissolved oxygen during the manufacturing process.

- lower % of oxygen content is good for durability of steel.
- On the basis of oxygen content, we classify steel as —
  - (I) Killed steel (oxygen < 30 ppm)
  - (II) Semi-Skilled steel (30 to 150 ppm)

  } ⇒ Generally used for structural steel as low % of oxygen is there.
  - (III) Rimmed steel (> 150 ppm).





- Structural steel are generally killed or semi-killed. (due to less oxygen content).
- Carbon percentage in percentage in structural steel is generally less than 0.25 %. (low carbon steel).
- Mild steel has carbon content upto 0.1 %.
- IS 800-2007 can be used for structural mild steel or high tension structural steel.

Difference in nomenclature b/w Reinforcement & structural steel :

Reinforcing bars.			structural steel.		
	fy	fu		fy	fu
Fe 250	250	412	Fe 410	250	410
Fe 415					
Fe 500					

Various Grades of steel : (IS : 800-2007)

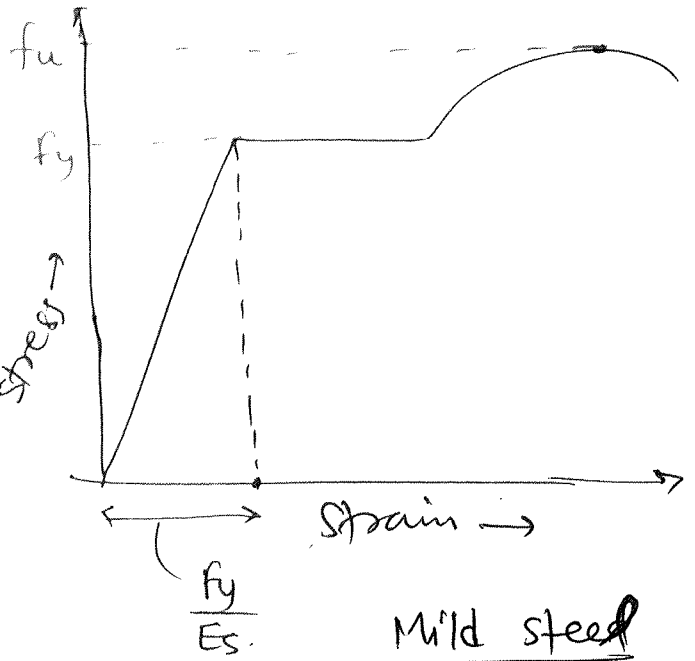
Grade.	Ultimate Tensile stress (fu) (MPa)	Yield stress (fy) (MPa)
E 250 (Fe 410) A, B, C	410	250
E 300 (Fe 440) A, B, C	440	300
E 350 (Fe 490) A, B, C	490	350
E 410 (Fe 540) A,	540	410

Note :

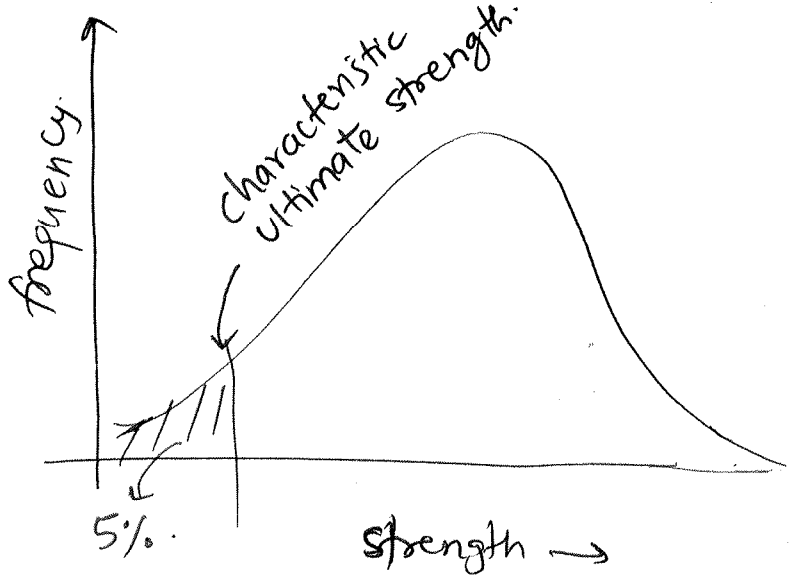
- structural steel is specified according to characteristic ultimate tensile stress. (i.e fu)
- characteristic ultimate tensile strength is the ~~stress~~ ultimate stress below which not more than 5% of the materials are expected to fall.

Example : Fe 410 → fu = 410 MPa.

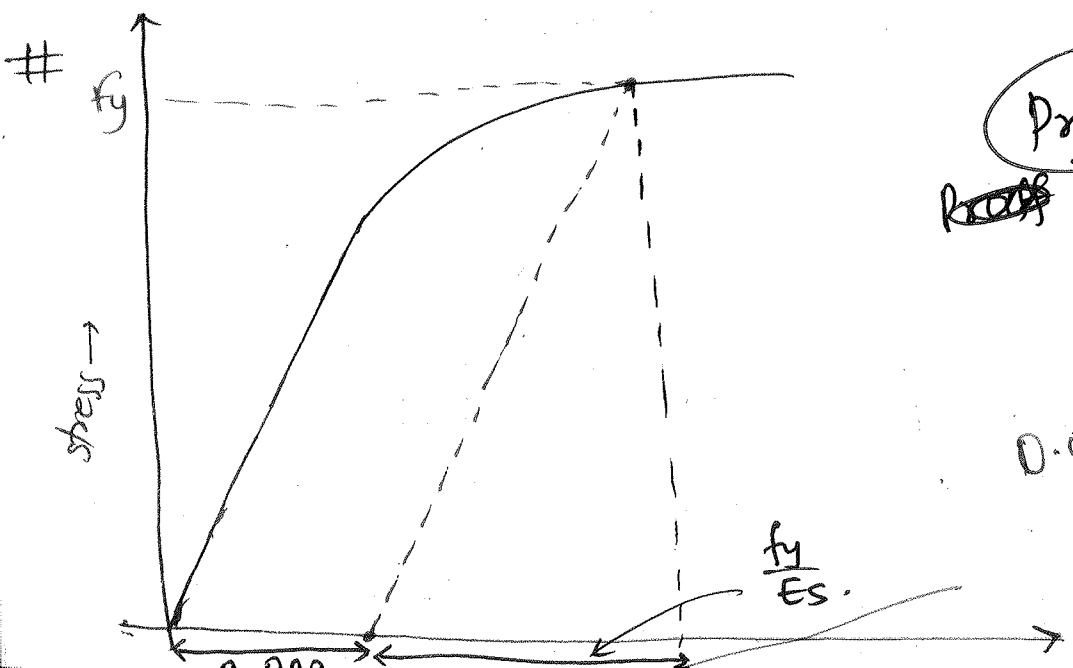
- Reinforcement bars in RCC are ~~p~~ specified as per yield stress.



Mild steel



frequency vs strength

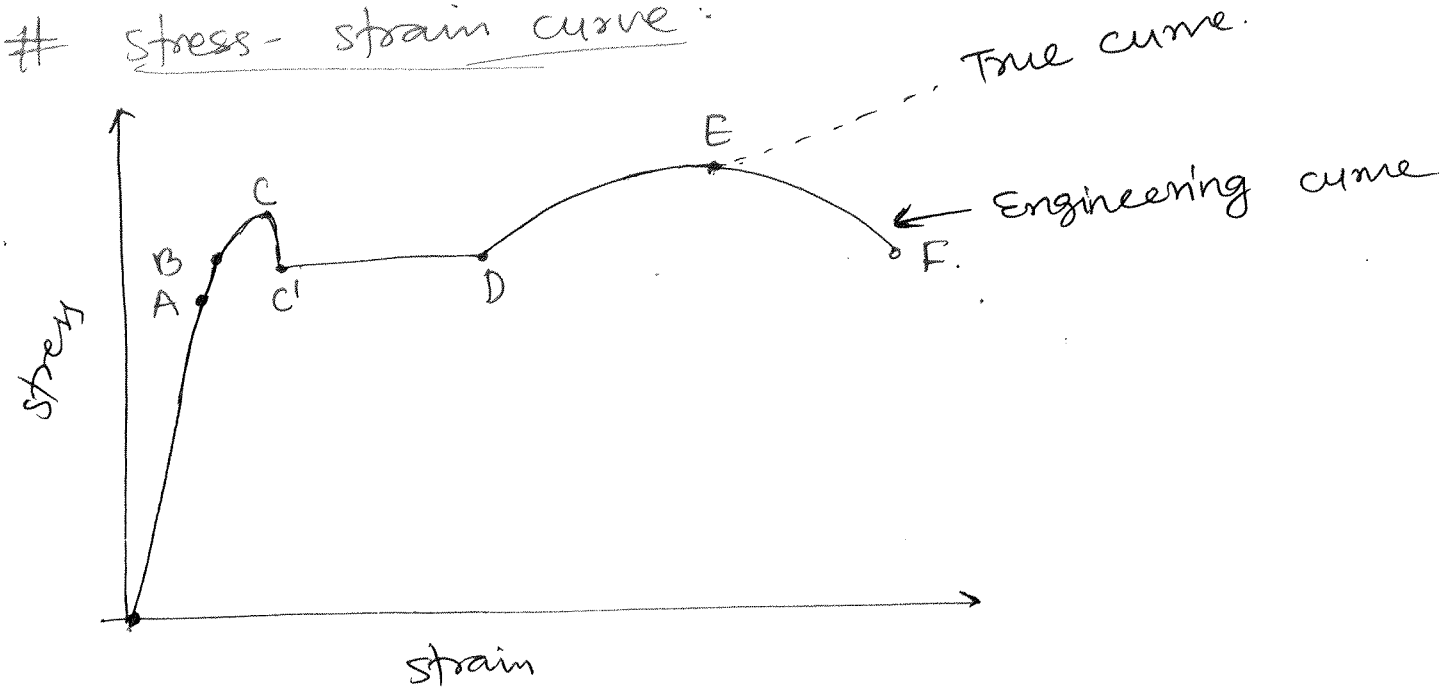


Proof stress

~~Proof~~

$0.002 + \frac{fy}{Es}$.

Stress - strain curve:



A → Proportionality limit

B → Elastic limit

C → Upper yield

C' → lower yield

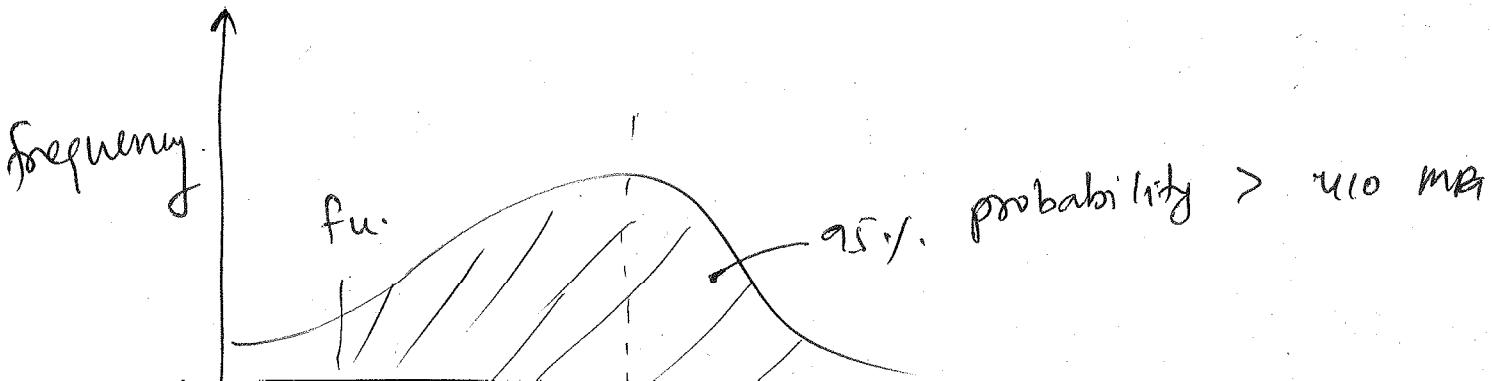
D → End of plastic zone / starting of strain hardening

E → ultimate point

F → fracture point.

(E) 250 (Fe 410 A) W → Better weld ability.

- (E) → from European code.
- 250 → characteristic yield strength
- 410 → characteristic ~~Yield~~ Ultimate Strength.
- A → Grade of steel.



- Thinner the section, higher is the strength due to higher amount of rolling, cold working, uniform rate of cooling. etc.

for Example:

E 250 (fe 410)			
thickness	< 20 mm	20 – 40 mm	> 40 mm
strength.	250 N/mm²	240 N/mm²	230 N/mm²

- Brittle fracture occurs due to higher tensile stress, lower temperature, thicker material, rapid change of stresses (like in case of fatigue).

- stainless steel is low carbon steel with chromium. Generally used for utensils) (chromium > (10.5%) by wt).

- Grade A is used for non-critical application i.e when members are not prone to brittle failure.

- Grade B is used for critical application when temp does not fall below 0°c and when parts are prone to brittle ~~failure~~ fracture or fluctuation of stress as in case of bridges.

- Grade c has a guaranteed low temp. (up to −40°c) and impact properties and shall be used when there is a chance of brittle fracture.

Properties of steel: (valid for all grades).

(I) Density of steel = 7850 Kg/m³

(II) Modulus of elasticity, E = 2×10^5 MPa

= 2×10^5 N/mm²