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MADE EASY
CIVIL ENGINEERING
R.C.C
BY-M.K Singh Sir

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

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EASY, , ACE , KREATRYX

**ESE, GATE, BEST Y KW , / E E
D/E/D DW @**

1. KE E / E /
2. E / E /
- D , E / E /
4. / E / E /
- /E D E /KE E / E /
6. KD /

,GATE, TEST @

❖ -W / & D /

❖ GATE

➤ E - ALL E / E / E

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EASY, ,ACE ,KREATRYX,GATE / ,GK

, YADAV, KD D ,&K E /KE , -GRAW , D ,W KE...K s

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R.C.C

8826630002 Mr. Singh.

GATE + ESE

- ① Basic properties
- ② Working stress method (SRB/WSM) - concepts
- ③ Limit state method (LSM) - concepts
 - a) Single Reinforced
 - b) Doubly Reinforced
 - c) T/L sections.
- ④ Shear & Torsion
- ⑤ Bond & Dev. Length
- ⑥ Beam & Lintels
- ⑦ slab
- ⑧ Column
 - a) Material Properties
 - b) Analysis of stress
 - c) Losses
 - d) slope & Deflection
 - e) Design of PSC member.

ESE syllabus → addition to GATE + ESE

- ⑩ foundation
- ⑪ stair case
- ⑫ Retaining wall
- ⑬ Water Tank
- ⑭ Masonry structure
- ⑮ Earthquake Engineering

QUESTION 1

- 1) The number of ways to choose 3 people from a group of 10 is $\binom{10}{3} = 120$.
- 2) The number of ways to choose 2 people from a group of 10 is $\binom{10}{2} = 45$.
- 3) The number of ways to choose 1 person from a group of 10 is $\binom{10}{1} = 10$.
- 4) The number of ways to choose 0 people from a group of 10 is $\binom{10}{0} = 1$.
- 5) The number of ways to choose 3 people from a group of 10 is $\binom{10}{3} = 120$.
- 6) The number of ways to choose 2 people from a group of 10 is $\binom{10}{2} = 45$.
- 7) The number of ways to choose 1 person from a group of 10 is $\binom{10}{1} = 10$.
- 8) The number of ways to choose 0 people from a group of 10 is $\binom{10}{0} = 1$.
- 9) The number of ways to choose 3 people from a group of 10 is $\binom{10}{3} = 120$.
- 10) The number of ways to choose 2 people from a group of 10 is $\binom{10}{2} = 45$.
- 11) The number of ways to choose 1 person from a group of 10 is $\binom{10}{1} = 10$.
- 12) The number of ways to choose 0 people from a group of 10 is $\binom{10}{0} = 1$.

QUESTION 2

- 1) The number of ways to choose 3 people from a group of 10 is $\binom{10}{3} = 120$.
- 2) The number of ways to choose 2 people from a group of 10 is $\binom{10}{2} = 45$.
- 3) The number of ways to choose 1 person from a group of 10 is $\binom{10}{1} = 10$.
- 4) The number of ways to choose 0 people from a group of 10 is $\binom{10}{0} = 1$.
- 5) The number of ways to choose 3 people from a group of 10 is $\binom{10}{3} = 120$.
- 6) The number of ways to choose 2 people from a group of 10 is $\binom{10}{2} = 45$.
- 7) The number of ways to choose 1 person from a group of 10 is $\binom{10}{1} = 10$.
- 8) The number of ways to choose 0 people from a group of 10 is $\binom{10}{0} = 1$.

Important in codes

- ① IS 456 - 2000 : Design of RCC structures.
- ② IS 1893 : Earthquake Resistant design of structure.
- ③ IS 13920 : Design & ductile detailing of RCC structures.
- ④ IS 3370 : Pt I to IV - Design of water tanks.
- ⑤ IS 1343 : Pre stressed concrete.
- ⑥ IS 1905 : Design of load bearing walls (masonry wall)

Important in Handbooks

Design Handbooks :-

- * 1 SP 16 → 1980 Design Aids for RC to IS 456
- * 2 SP 23 → 1982 Handbook - Concrete mixes
- * 3 SP 24 → Explanatory handbook - IS 456 - 1978
- * 4 SP 34 → Handbook - Concrete Reinforcement and Detailing.

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Handwritten text, likely bleed-through from the reverse side of the page. This section contains a list of items, possibly names or titles, arranged in a columnar fashion.

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BASIC Properties of Cement Concrete and steel

RCC (Reinforced Cement concrete) :-

- ① Cement concrete - * mainly for compression
- * Tensile strength is very low.
- ② Steel Reinforcement - * for resisting mainly tension
- * as well as compression

Cement concrete

* → Mixture of Water, Cement, Sand (fine Aggregate), Stone (Coarse Aggregate) & Admixtures.

* Cement concrete with Reinforcement is called Plain Cement concrete.

Cement Mortar = Cement + Sand + Water

Cement concrete = Cement + Sand + Water + Stone aggregate
+ admixture.

Cement concrete →

Cement concrete reinforced by steel is called RCC (Reinforced cement concrete).

Plain cement concrete (PCC) is without steel

① Water for concrete → P_w

* Water fit for human are good for concrete

* Water used for concrete should be clean &

→ free from oil, salts, sugar, organic materials etc.

→ that may not harm concrete.

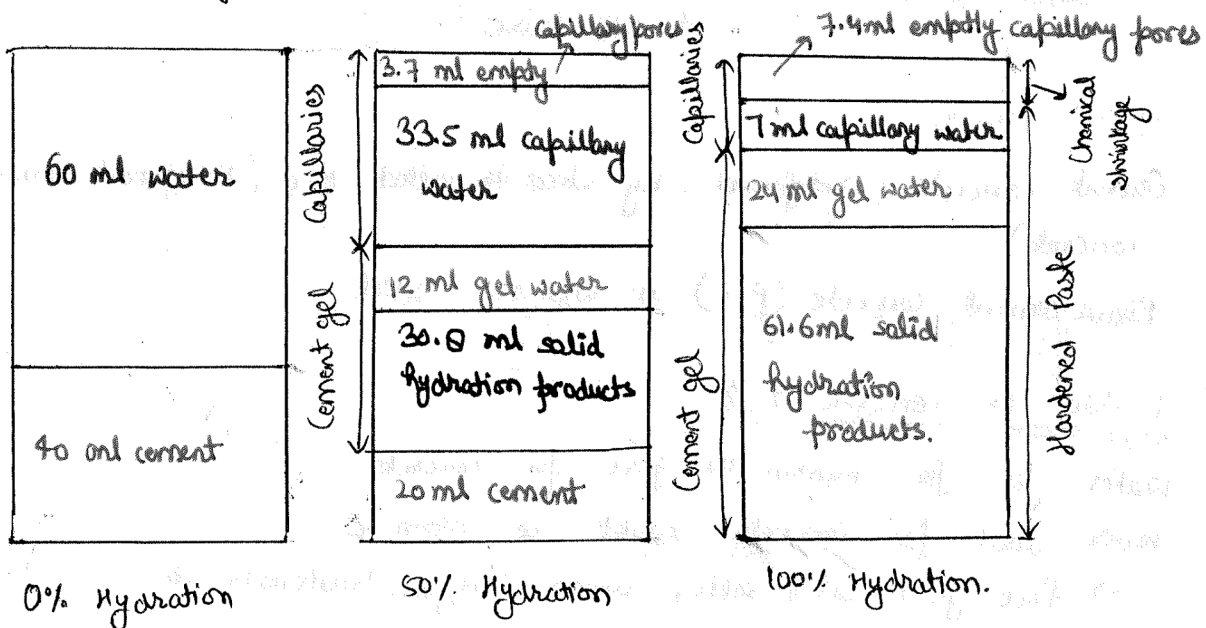
* Sea water should not be used for RCC.

* Salt of sea water is harmful for concrete.

- * In extreme case it may be used for PCC
- * The pH value of water shall not be less than 6
- * $\text{pH} < 6 \rightarrow$ Highly acidic :- Not acceptable
- * $\text{pH} = 6 \rightarrow$ acidic :- Acceptable
- * $\text{pH} = 7 \rightarrow$ Neutral :- Best water for concrete.
- * $\text{pH} > 7 \rightarrow$ Slightly alkaline water is also acceptable.

Water in Cement concrete is for :-

- ① Combined water \rightarrow Chemically combined water with the cement for hydration. it is non-evaporable.
- ② Gel water \rightarrow Held physically or adsorbed on the surface area of the 'cement gel'. A fraction of gel water is evaporable.
- ③ Capillary water \rightarrow Occupies the 'capillary pores' that constitute the space in the cement paste. This water is easily evaporated.



Q Maximum limit of suspended matter in water

- a) 200 mg/Litre
- b) 2000 mg/L ✓
- c) 3000 mg/L

Q Maxm limit of Organic matter in water

- a) 200 mg/L ✓
- b) 2000 mg/L
- c) 3000 mg/L

Permissible Limits of Solids in water

<u>Tested for</u>	<u>Permissible Limits</u>
* Organic	200 mg/L
* Inorganic	3000 mg/L
* Sulphates	400 mg/L
* Chlorides	2000 mg/L — for PCC 500 mg/L — for RCC
* Suspended matter	2000 mg/L

② Cement

① OPC ordinary Portland cement →

- a) 33 grade OPC
- b) 43 grade OPC
- c) 53 grade OPC

② Rapid Hardening cement — Becomes hard rapidly

③ Portland Pozzolana cement — Use Pozzolana

④ Hydrophobic cement — water repellent

⑤ Low Heat cement — Produce less heat

⑥ Sulphate resisting Portland cement.

③ Aggregates →

a) Fine Aggregates = Sand (up to 4.75 mm size)

b) Coarse Aggregates = Stone chips of mixed sizes
4.75 mm to 20 mm or
4.75 mm to 40 mm.

* Size > 4.75 mm & larger

* Angular are better than rounded aggregates.

* for RCC - 20 mm aggregates are generally used.

→ (size 20 mm or less - mixed sizes)

→ Well graded stone aggregates are better

→ Uniformly (poorly) graded not suitable.

* 10 mm size - for closely placed steel sections.

* 40 mm size - for PCC etc.

Classification of aggregates →

① Fine aggregate → sand and/or crushed stone

→ < 4.75 mm

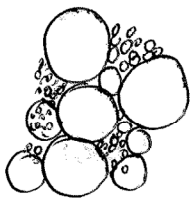
→ Fine aggregate usually 35% to 45% by mass or volume of total aggregate etc.

② Coarse aggregate → Gravel & crushed stone

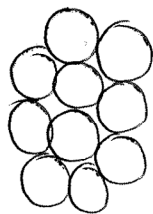
→ > 4.75 mm

→ Typically b/w 9.5 & 37.5 mm

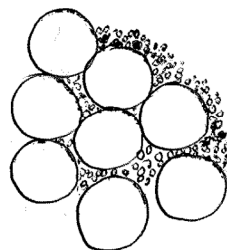
Types of Aggregates :-



Well Graded



Poorly Graded



Gap Graded

NOTE

→ Concrete Pump used for Pumping concrete.

Concrete vibrator used for proper compaction of concrete.