ABOUT THIS STUDY NOTES

This “Engineers’ Quiz - Study Notes” has been designed in such a way that you can revise a topic/chapter/subject in 1-2 hours. Considering the scenario that your exams are one or two days from now and you need to quickly revise a chapter/subject, but going through your full notes again seems difficult as you have to revise all subject within one or two days.

To solve this problem we have come up with “Engineers’ Quiz - Study Notes HYP (High Yield Points) Series”. A comprehensive study note for each and every subject of Civil Engineering. Our HYP Series includes one line concepts, formulas, examples, tips & tricks to memories formulas and more.

This Study Note is designed to help students preparing for examinations like ESE, GATE-PSU, SSC JE and other examinations related to Civil Engineering.

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**Estimation:** It is a process of calculating the quantities and cost of various items required in a construction work.

**Purpose Of Estimation:** To ascertain amount of man, machine, money and time required in a particular work.

**Type of Estimates:**
1. Detailed Estimate
2. Preliminary/Approx/Rough Estimate
3. Quantity Estimate/Survey
4. Revised Estimate
5. Supplementary Estimate
6. Revised and Supplementary Estimate
7. Complete Estimate
8. Annual Maintenance/Repair Estimate

**Detailed Estimate:**
> Best and most accurate estimate.
> Includes: Report, specification, detailed drawing, design data, basis of rate adopted.
> Needed For: Technical sanctions, administrative approvals, contracts, etc.

**Preliminary/Approx/Rough Estimate:**
> Used to find approx. cost in short time,
> It is worked out by knowing the rate of similar work and from practical knowledge.

It includes- Plinth Area/Square meter method, Cubic Rate/CubicMeter Method, Service Unit or Unit Rate Method, Bay Method, Approx. Quantity with Bill Method, Cost Comparison Method, Cost from Material and Labour.

**Quantity Estimate:**
> Quantities are worked out then multiplied by unit rate to get the cost estimate.
> Complete list of quantities for all items of work.

**Revised Estimate:**
> It is a detailed estimate for the revised quantities and rate of items of work.
> Adopted when there is no structural change (during revision of work).
> Always submitted for fresh technical sanctions.
> Prepared When: Estimate exceeds by 5% for rates being found insufficient. If Sanctioned estimate is more than requirement. Expenditure of work is likely to exceed by more than 10%.

**Supplementary Estimate:**
> If some additional work (in a running project) is required to be done of structural nature in addition to sanctioned strength of work then a separate estimate is done.
> Structural changes occur.
> Done as detailed estimate.

**Complete Estimate:**
> Land Cost: Cost of land + Survey + Permits + Misc.
> Engineering Cost: Design + Supervision.
> Permits: Electrical + Water.

**Annual Maintenance/Repair Estimate:**
> Renewal, Replacement, Repairs
> Prepared as detailed estimate.

**Approximate Estimate:**
> Purpose:
> To investigate feasibility, benefit & cost comparison.
> To save time and money. Alternate plans.
> For administrative approvals, insurance, tax schedule.

**Important Terms:**
1. **Plinth Area:** Build up covered area at plinth level.
   Includes: Area of floor level excluding plinth offsets, Staircase Cover, Internal Shaft, Lift Well with landing, Machine Room, Area of porch.
   Excludes: Loft Area, Balcony, Architectural features, Open platform.

2. **Floor Area:** Plinth Area - Area of walls

3. **Carpet Area:** Floor Area minus Verandah, corridor, entrance hall, porch, staircase, bathroom, kitchen, store, machine room etc.
   > Basically it is the general area of floor where you can think of keeping carpet.

4. **Covered Area:** Ground area covered above plinth area.
   Excludes: Pump house, Garbage shaft, Swimming Pool etc.

5. **Rentable Area:** Carpet area + kitchen + bathroom + store - staircase landing.
**Cube Rate/Cubic Metre Method:**
> Accurate than Square metre method.
> Plinth Area x Height of building (height-half of foundation depth to top of the building).

**Approx Quantity with Bill Method:**
> Not as accurate as Plinth area or cubic rates method.
> All items are multiplied by cost of construction per metre length of wall.
> Calculate wall sections from plan, it includes all items i.e. foundation to roofing.

**Service Unit/ Unit Rate Method:**
> Cost of unit quantities worked out first.
> Cost per unit x no. of such units.

**Bay Method:**
> Approx. estimate: No. of bay x cost of such bay.

**Accuracy:** Cubic Method > Plinth Area Method > Approx Quantity Method.

**Method Of Building Estimate:**

**Earthwork - Excavation**
- Filling - Foundation Filling
- Plinth Filling

**Damp-Proof Course (DPC)**
> Layer of cement concrete with waterproofing compound.
> Applied between plinth and superstructure.
> To check rise of water by capillary action from ground.
> Calculated as length of superstructure wall x thickness of wall minus openings like doors, verandah in sq-metre.

**Method:**

1. **Long wall short wall / PWD Method/ Out-to-out in -to-in method.**

> Determine long side/wall from plan in one direction and measured out to out along the central line.
> Shorter wall(s) generally perpendicular to long wall are measured in to in along central line.
> Used for Measurement Book (MB) entries.

**2. Central Line Method:**
> Determine total central line length of walls,
> Different sections of wall in a building central line length for each length shall be worked our seperately.
> Central line is multiplied with breadth and depth of respective item.
> Quick method, more accurate in symmetrical wall layout.
> Used for prepping estimates.

**3. Crossing Method:**
> Same principal as central line method.
> Calculate perimeter of building and deduct wall thickness 4-times to get central line length.

**> RCC Works <**

RCC: Steel, Cement, Sand, Coarse Aggregate, Water.

**Cement:** weight by weight not by volume.
  cement bag - 50kg

**Sand:** Measured by weight or volume with bulking allowance.
  Bulking of sand: Increase in volume of dry sand by absorption of moisture, finer the sand more is the volume increase.

**Coarse Aggregate:** Measured either by wt. or volume, wt. measurement is more important.

**Water:** Volume wise as per Slump Test.
  Water required by concrete= 28% wt of cement + 4% wt. of aggregate.

**Water-Cement Ratio:**

<table>
<thead>
<tr>
<th>Proportion</th>
<th>1:2:4</th>
<th>1:1.5:3</th>
<th>1:1:2</th>
</tr>
</thead>
<tbody>
<tr>
<td>W/C</td>
<td>0.58</td>
<td>0.51</td>
<td>0.43</td>
</tr>
<tr>
<td>Grade</td>
<td>M15</td>
<td>M20</td>
<td>M25</td>
</tr>
</tbody>
</table>

**Concrete Proportion:**
Cement : Sand : Coarse Agg: 1 : n : 2n

**Reinforcement:**

**Development length:**

<table>
<thead>
<tr>
<th>Tension</th>
<th>Tension</th>
<th>Compression</th>
</tr>
</thead>
<tbody>
<tr>
<td>WSM</td>
<td>LSM</td>
<td>WSM/LSM</td>
</tr>
<tr>
<td>( L_{d} = \frac{\Phi \sigma_{d}}{4 \varepsilon_{ld}} )</td>
<td>( L_{d} = 0.87 \frac{\Phi \sigma_{d}}{4 \varepsilon_{ld}} )</td>
<td>( L_{d} = 0.8 \frac{\Phi \sigma_{d}}{3 \varepsilon_{ld}} )</td>
</tr>
</tbody>
</table>

**Lap Length:**
In Tension: \( L_{t} = L_{d} \)
In Compression: \( L = L_{c} \) or not less than 24d
Lap length includes anchorage value of hook in tension.
-If two bars of different dia is to be lapped then lap length is calculated as per smaller dia bar.

**End Anchorage:**
For Plain Mild Steel Bar- Bond resistance value of anchorage. d is diameter in mm.

<table>
<thead>
<tr>
<th>Bend Type</th>
<th>Required Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 Degree Bend</td>
<td>8d</td>
</tr>
<tr>
<td>45 degree bend</td>
<td>12d</td>
</tr>
<tr>
<td>Semi-circular</td>
<td>16d</td>
</tr>
</tbody>
</table>

**Important Information:**

- Weight of M.S Bar/metre = 0.00618d^2, d in mm
- Weight of Plate/m = 7.85t, t is thickness in mm
- Weight of 1 cum of M.S bar = 7850 kg
- Volume of 1 Bag of cement = 0.0347 m^3
- Density of steel = 7850kg/m^3
- Density of cement = 1440 kg/m^3
- Density of coarse aggregate = 2440kg/m^3

> **Valuation**<

**Value:** Worth of property at present, it varies from time to time, depends on demand and supply.

**Cost:** Original cost of construction, It decreases with age of property.

**Price:** Selling price.

**Valuation:** Art of assessing present fair value of property.

Purpose of Valuation:
- Rent fixation, Insurance, Tax fixation
- Sale, Gift tax, Partition of joint property, Assemenet of income or stamp fees, Betterment charges.

**Gross Income:** Total income without deducting outgoings.

**Outgoings:** Expenses to be made by virtue of owing a property like maintenance cost, Repairs, Management and collection charges, Insurance, Loss of rent, Voids, Sinking fund, Income tax etc.

Net Income: Gross Income - Outgoings

**Scrap value:**
- Sales value of materials of a property at the end of its useful life.
- It’s around 10% of the cost of structure.
- It is counted in depreciation of a property.
- Not counted as a minus quantity.

**Salvage Value:**
- Estimated value of a property as a whole at the end of its useful life.
- It is not included in depreciation calculation.
- It can a minus quantity.

**Market Value:**
- Fixed by purchaser, It may increase or decrease,
- Depends in demand and supply

**Book Value:**
- Fixed by rate of depreciation, value always decrease,
- Not applicable to land, independent of demand and supply.

**Sinking Fund:**
- Amount that need to be set aside at regular interval out of the gross income so that at the end of useful life of the property, the fund should accumulate to the initial value.
- for land it is not calculated.
- Calculation is made at 90% cost of property/building.

If, S: total amount of sinking fund,
I: Annual installment,
i: rate of interest,
n: no. of years,
I_i: coefficient of sinking fund,

\[ I = \frac{S_i}{(1+i)^n - 1} \]

**Depreciation:**
- Loss of value of property due to its use.

**Determination of Depreciation:**

1. **Straight Line Method:**
- Loss in value at a constant amount each year.
if, C: Total cost, Sc: scrap value, n: no. of years,

\[ D = \frac{C - Sc}{n} \]

2. **Declining Balance Method:**
- Loss of value at a constant rate
p: percentage rate of annual depreciation.

\[ p = 1 - \left(\frac{Sc}{C}\right)^\frac{1}{n} \]

3. **Sinking Fund Method:**
- Rate of depreciation = X * Y
\[ x = \frac{i}{(1+i)^n - 1}, y = \frac{(1+i)^n - 1}{i} \]
both “n” are different.
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