Complete syllabus

- **Importance of Interdisciplinary approach in Civil Engineering:** Role of Engineer in national development, Importance of an interdisciplinary approach in engineering. Importance of various areas of Civil Engineering: Surveying, Construction engineering, Fluid Mechanics, Transportation engineering, Irrigation engineering, Project management, Structural and Earthquake engineering, Geology, Environmental engineering, Infrastructure Development.
- **INFRASTRUCTURE and Project Management:** Project feasibility studies, Interdisciplinary infrastructure provisions, monitoring and maintaining projects, software used in project management, Drone Survey, Management and control of resources, Smart cities.
- **Advanced Survey Techniques :** Conventional Survey: Contouring, Types of maps, and their uses, Google Maps; Modern survey methods using levels, Theodolite, EDM, laser, total station and GPS, GIS, Measuring areas from maps using digital planimeter, Surveying software, surveying by total station, Photographic and Aerial Surveys.
- **Modern Construction Techniques and Materials:** Introduction to automation in construction, MIS, MS Project, Conventional materials, Eco-friendly materials in construction, Introduction to Smart Materials.
- **Integrated built environment and byelaws :** Principles of Planning(only Introduction), Byelaws, Concept of built up area, carpet area, plinth area, Plot area, FSI, Role of byelaws in regulating the environment, Concept of Green building.
- **Sustainable development and waste management:** Methods of Harnessing the energies, Effect of pollution on environment, Engineer's role in achieving sustainable development, Environmental Impact Assessment (EIA), Solid waste management, e waste management

Basic of Civil Engineering

Module 1

Importance of Interdisciplinary approach in Civil Engineering

Vision of Institute

- To be a leading University of Excellence, promoting the "Culture of Peace" through Value-based "Universal Education System", with a firm belief that "Union of Science and Religion / Spirituality alone will bring peace to mankind"
- To be a world class space of intellectual distinction in creating extensively trained professionals who will stand for eternal human values and world peace as complete global citizens

Mission Of Institute

- To create a synergy of academics with technology, technology with research, research with industry, industry with economy and economy with social innovation, leading to world peace and positive change in the society
- To identify, enhance, hone and nurture the strength of every student to apply scientific knowledge to touch the life of human beings
- To foster the spirit of inquiry and imagination in students, to push the envelope of human knowledge and come up with innovative and ground-breaking solutions for well-being of the world
- To create value and intellectual capital for society that will act as a prime mover for development of the society
- To promote the 'Idea of India' by sensitizing students about the ethos of democracy, vision of leadership and culture of good governance
- Co-creation and partnership with individuals and organizations that can support students realize their supreme potential

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Program Outcomes

- Engineering Knowledge
- Problem analysis
- Design/Development of Solutions
- Conduct investigations of complex problems
- Modern tool usage
- The engineer and society
- Environmental and sustainability
- Ethics
- Individual and teamwork
- Communication
- Project Management and Finance
- Life Long learning

Course Objectives

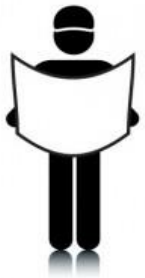
1. To impart inter-disciplinary approach essential for an engineer.
2. To prepare engineering students with modern techniques used in Civil Engineering.
3. To prepare students to make drawings using different software.
4. To prepare engineering graduates with the knowledge of bye laws of construction and sustainable development using concept of environment.

Course Outcomes

1. Differentiate between various branches of civil engineering and understand the significance of an inter-disciplinary approach needed for an engineer.
2. Apply modern survey methods in relevant field applications.
3. Understand the role of a civil engineer in planning, regulating constructions and achieving sustainable development.



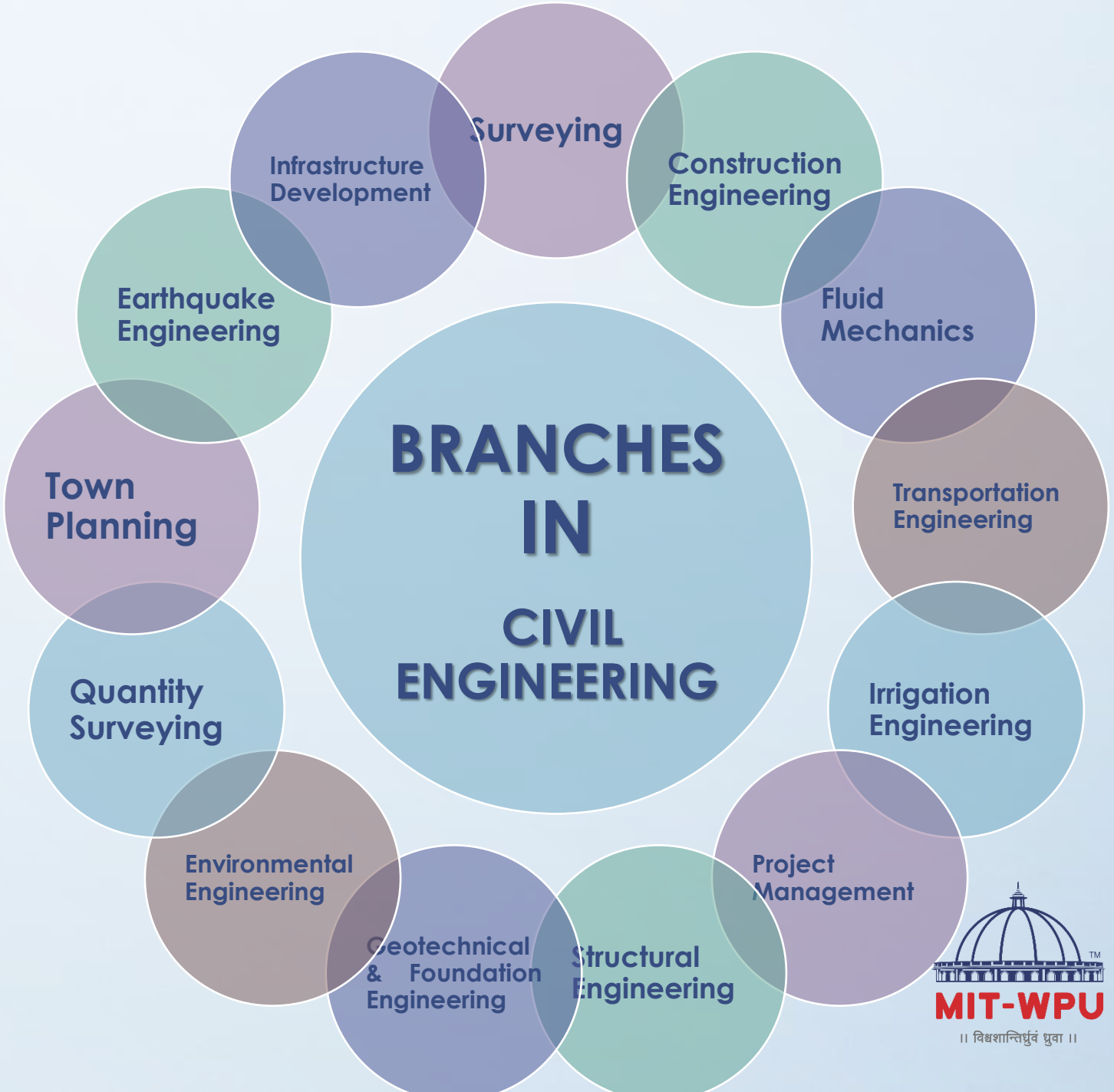




Branches of Civil Engineering





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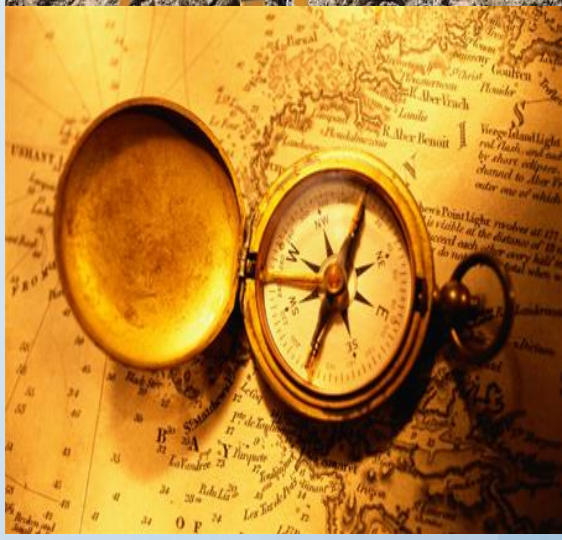
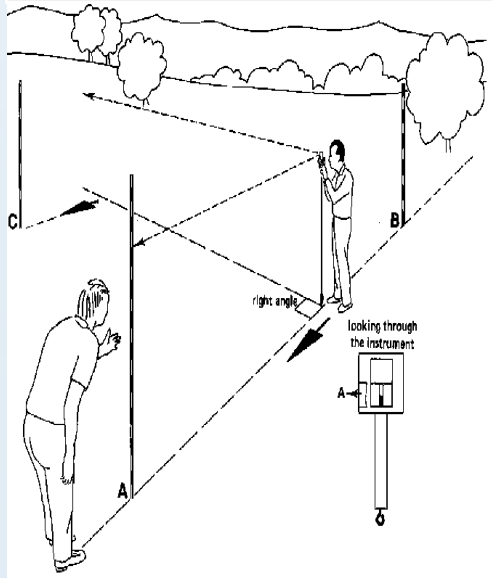
1. Surveying

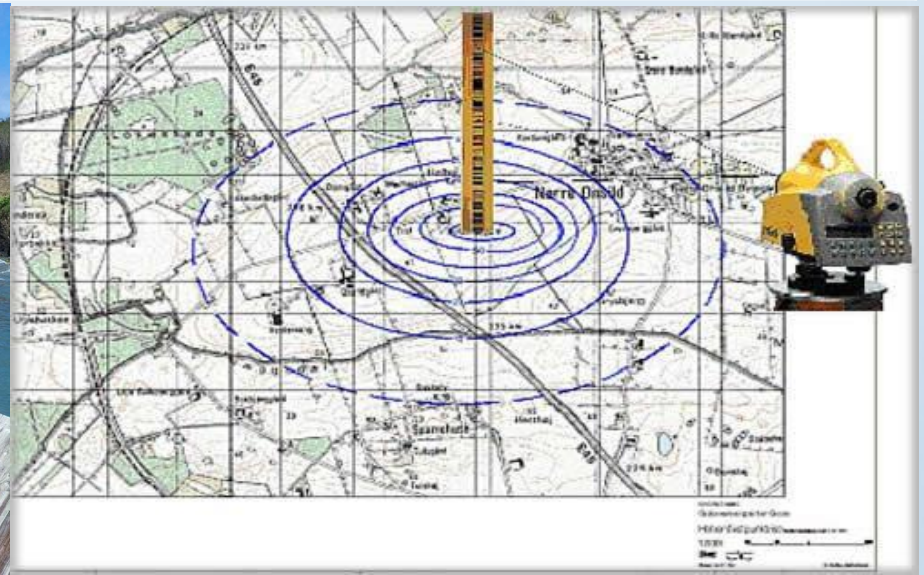
- It is a branch of civil engineering which enables the engineer:
  1. To prepare maps and plans of the existing features of ground from the field observations taken in the horizontal plane.
  2. To determine or to establish relative positions of the points on the surface of the earth. Surveying.
- Linear measurement, angular measurement in horizontal and vertical plane.



• Classification of Surveying

Plane surveying	Geodetic surveying
Type of surveying where the curvature of the earth is neglected. Assumed to be a flat surface.	Type of surveying where the curvature of the earth is taken into consideration.
Used for a small portion of earth's surface and area involved is less than 250 sq. km.	Large distance and areas are to be covered. Government agencies.





• Surveying Instruments

Vernier Theodolite

Survey Compass (Prismatic compass)

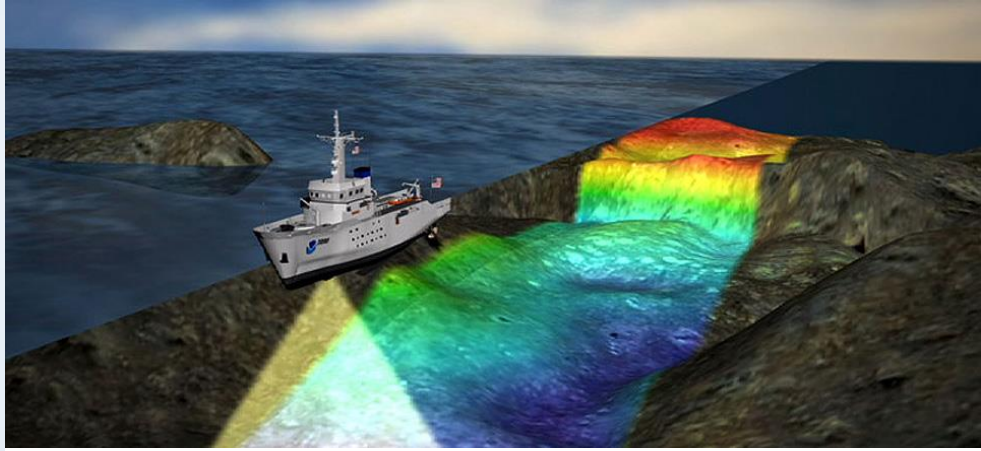
Auto Level

Digital Theodolite

Total Station

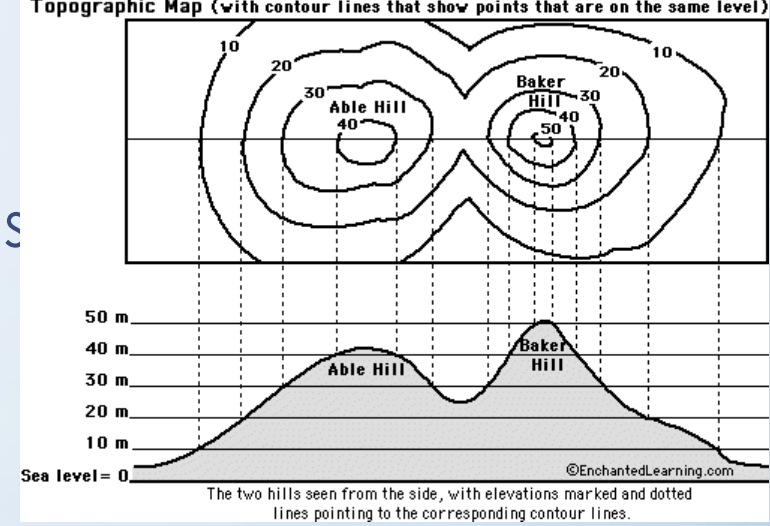
- # Applications

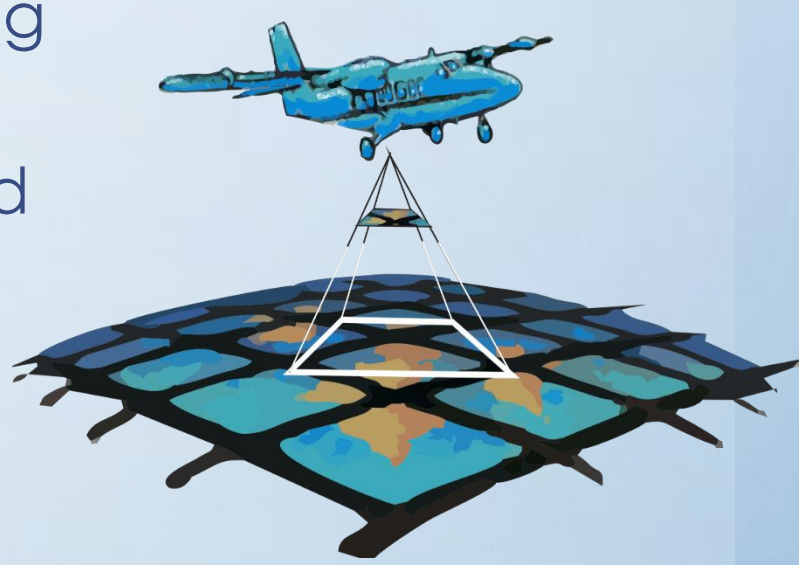
1. Maps and plans of existing area of land or ground can be prepared
2. Relative positions of the points on the earth surface can be determined.
3. Alignment of road, railway line, electric tower line, tunnel, bridges, electric poles and marine structure can be fixed
4. Elevation of various points can be found out
5. Slope or gradient for water supply, drainage, gas line and for road work can be laid



LAND USE PLANNING

6. Contour maps can be prepared to get an idea of ground profile from which the projects such as dam, canal, buildings, roads and railway track are further carried out. This is known as **topographical survey**
7. Plotting of irregular boundaries of plots & existing structure on paper
8. Carrying out the survey on lakes, rivers, nala and sea to study the bed profile. This is known as **hydrographic survey**.
9. Carrying out **aerial photography** of earth's surface using aerial cameras to get the information about town planning, understanding forest cover, ground water hydrology
10. Carrying out city surveying





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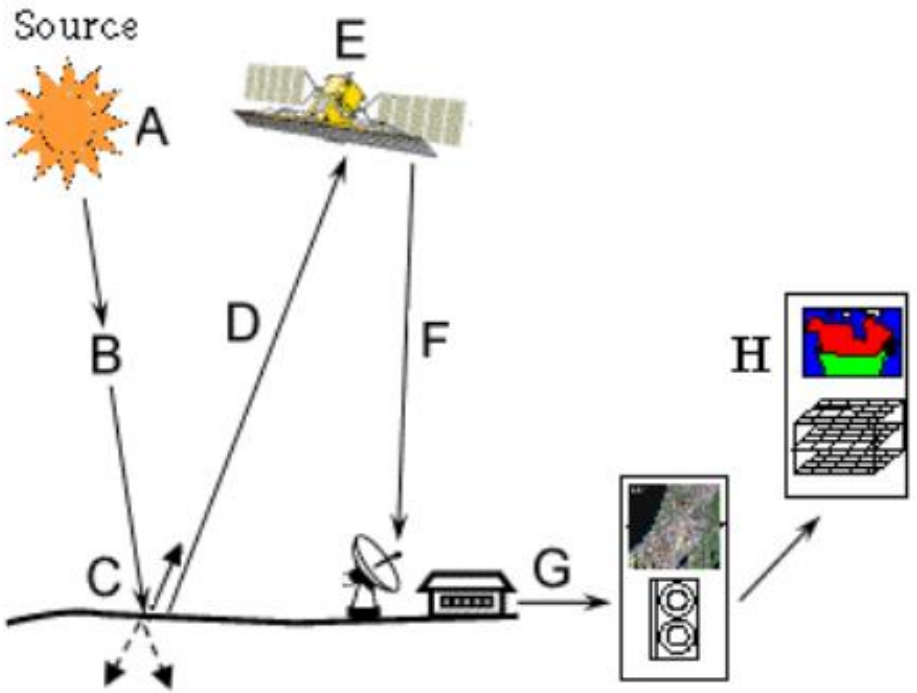
• Remote sensing

- Remote sensing is the acquisition of information about an object or phenomenon, without making physical contact with the object.
- Advanced method of surveying where pictures of the earth surface are taken from unmanned satellites revolving around the earth in orbits. (https://www.youtube.com/watch?v=N49PzLDUIFQ) (https://www.youtube.com/watch?v=-7_0Z_tm2Z8)



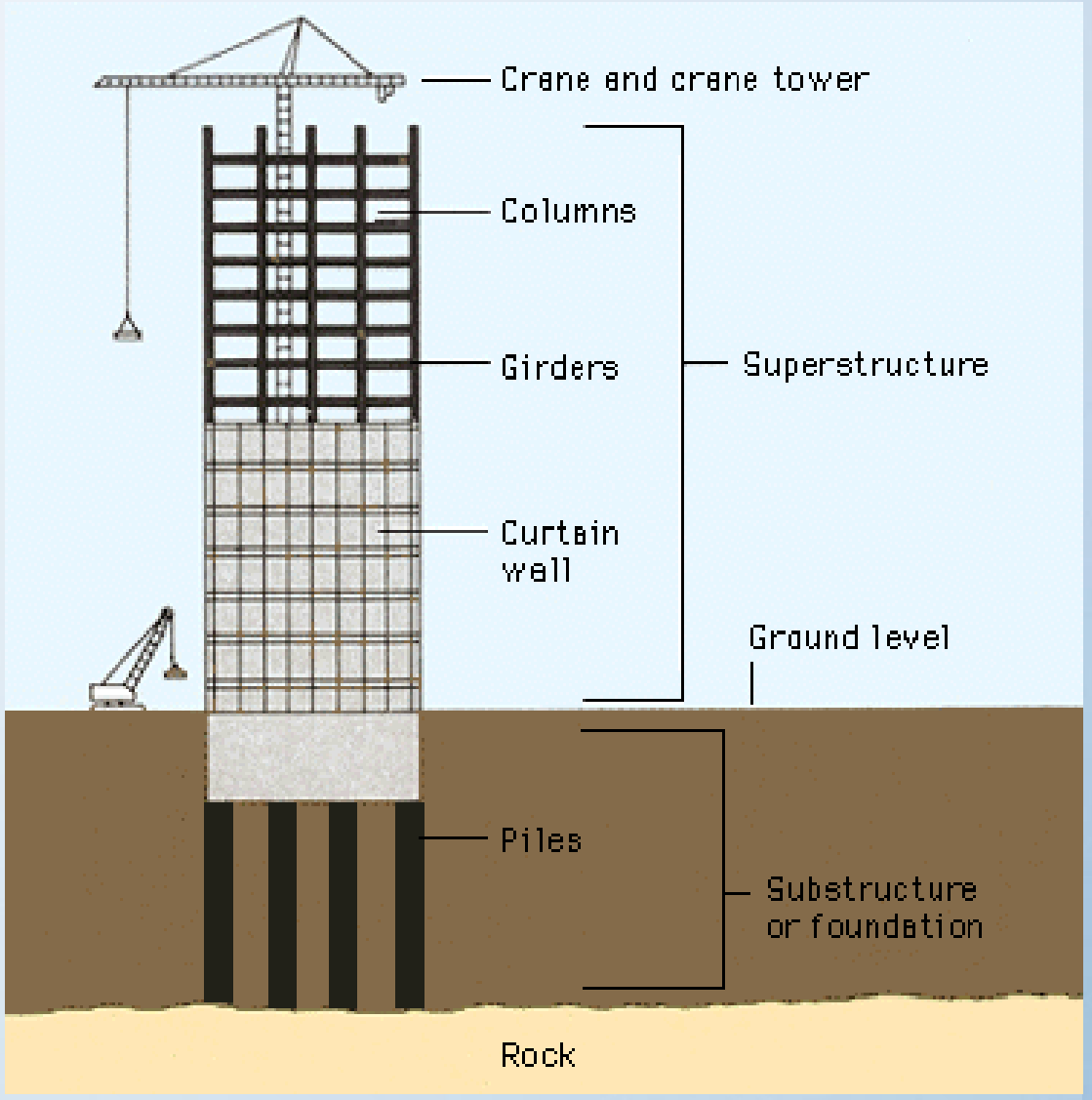
A. Emission of electromagnetic radiation: The Sun or an EMR source located on the platform
B. Transmission of energy from the source to the object: Absorption and scattering of the EMR while transmission
C. Interaction of EMR with the object and subsequent reflection and emission
D. Transmission of energy from the object to the sensor
E. Recording of energy by the sensor: Photographic or non-photographic sensors
F. Transmission of the recorded information to the ground station
G. Processing of the data into digital or hard copy image
H. Analysis of data

- # Applications

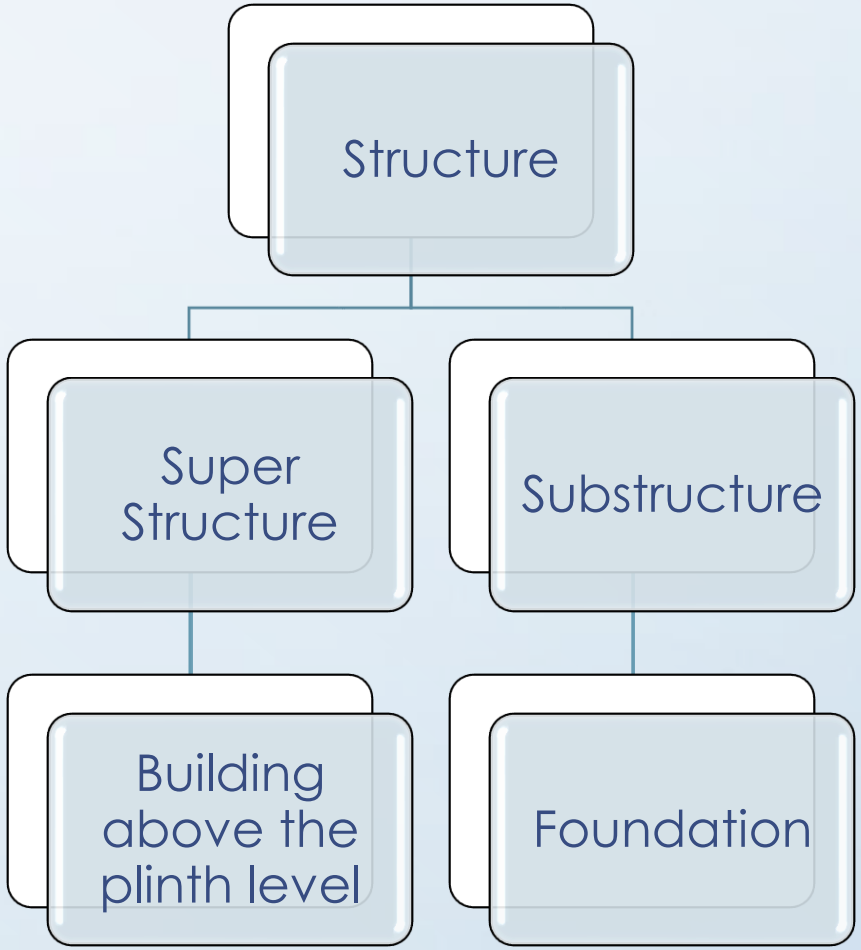
2. Construction Engineering

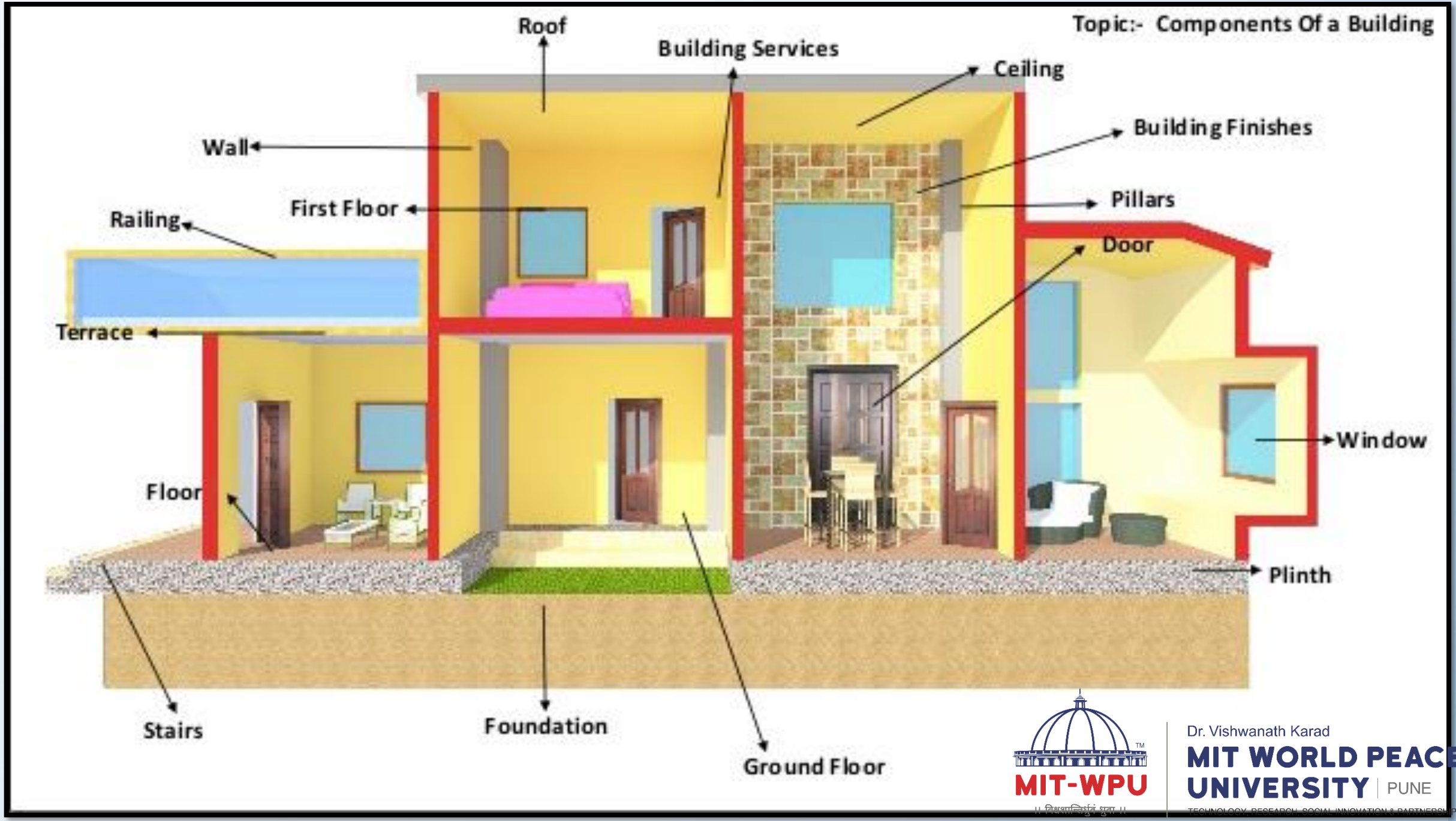
Definition : It is a branch or basic area of civil engineering in which construction of various structures is involved.

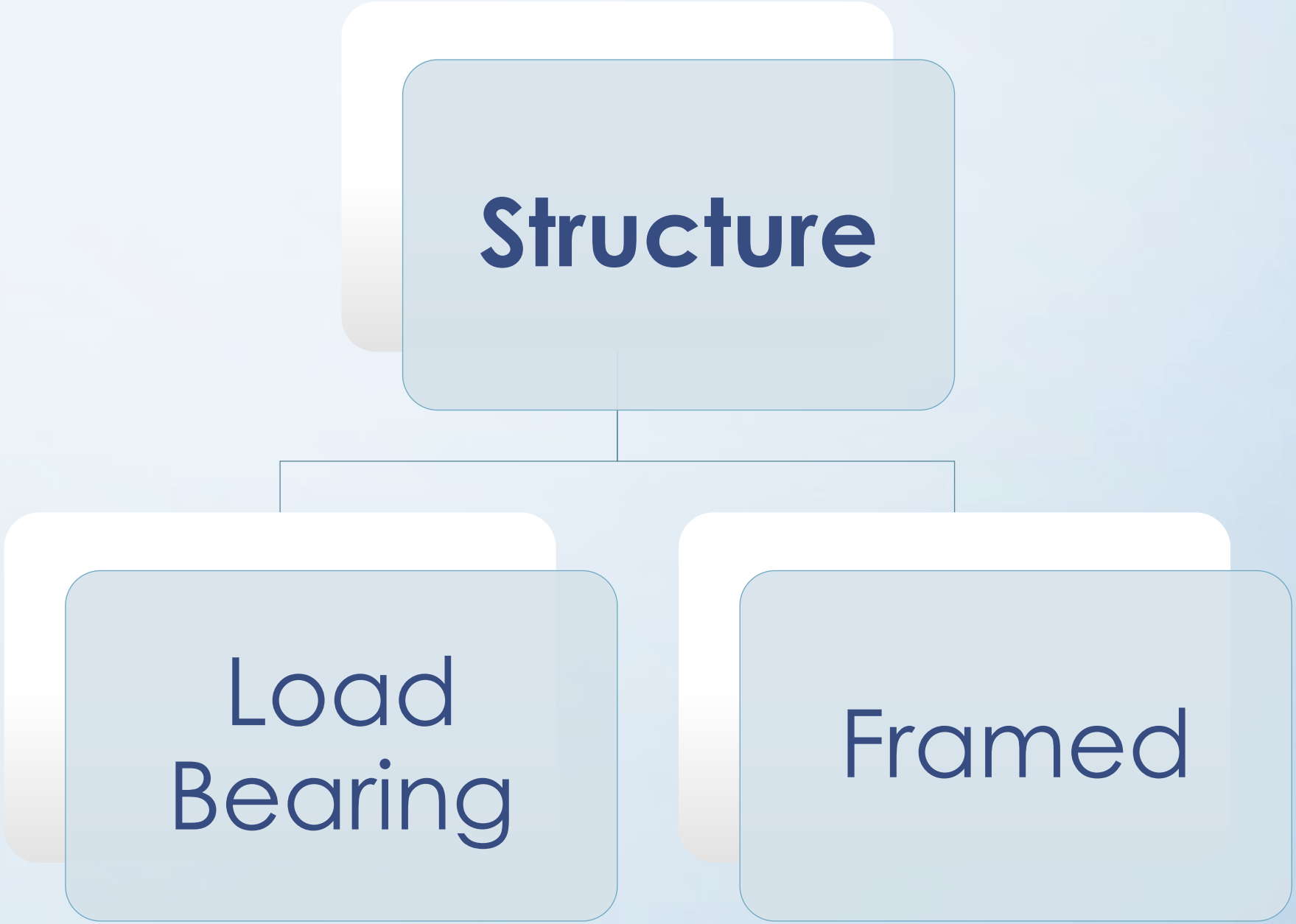
Construction activities : - Excavation, foundation, footing, masonry, concreting, finishing etc.



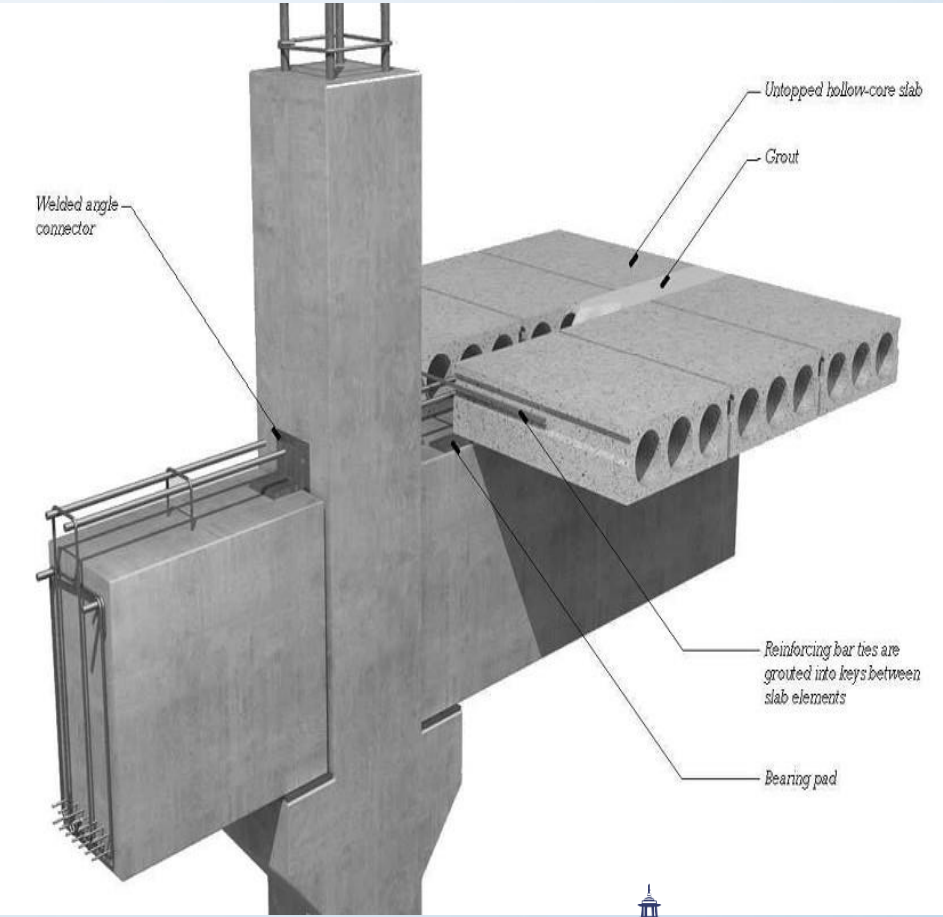
- # Components of structure



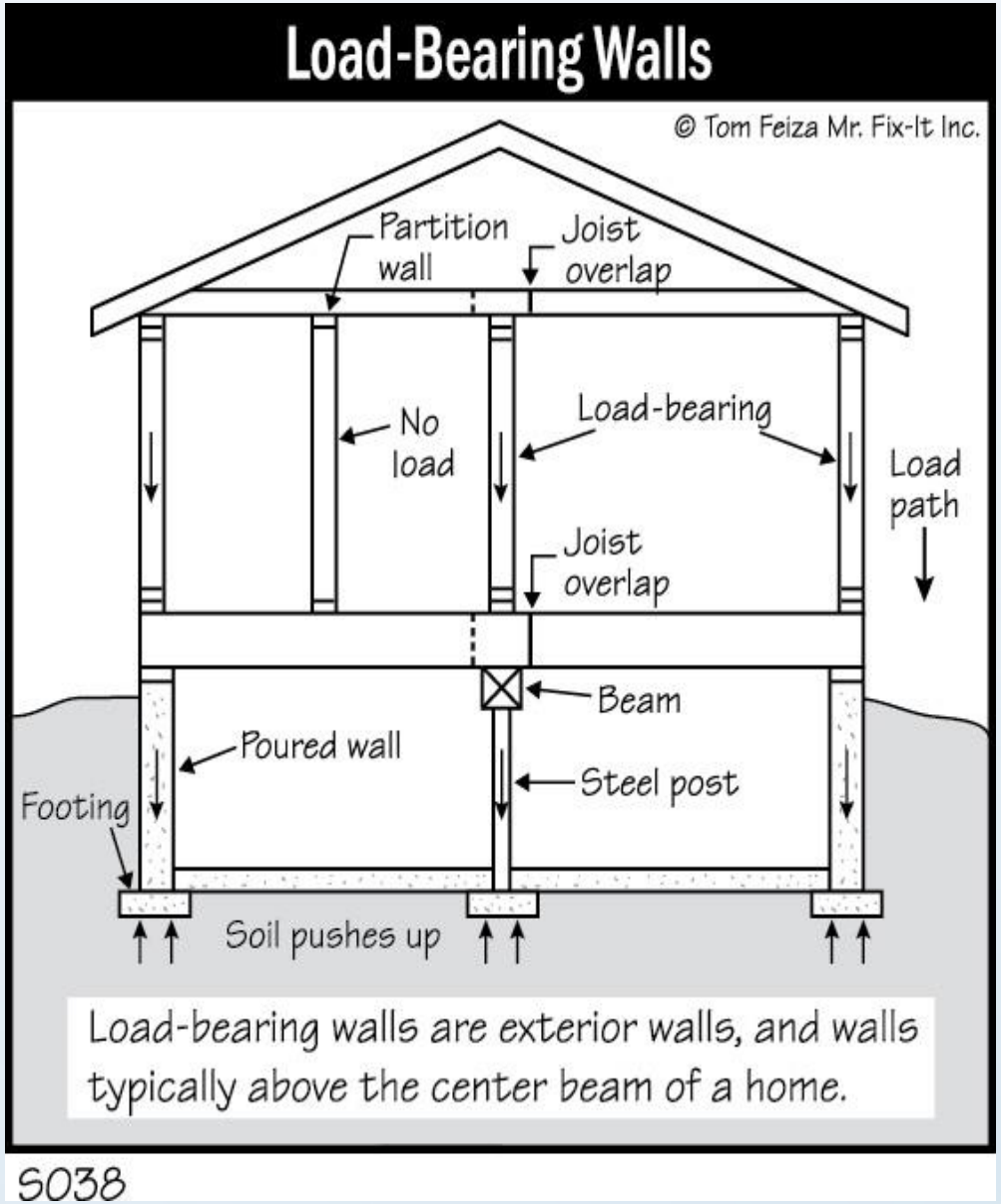



Structure
Load Bearing
Framed

Framed structure

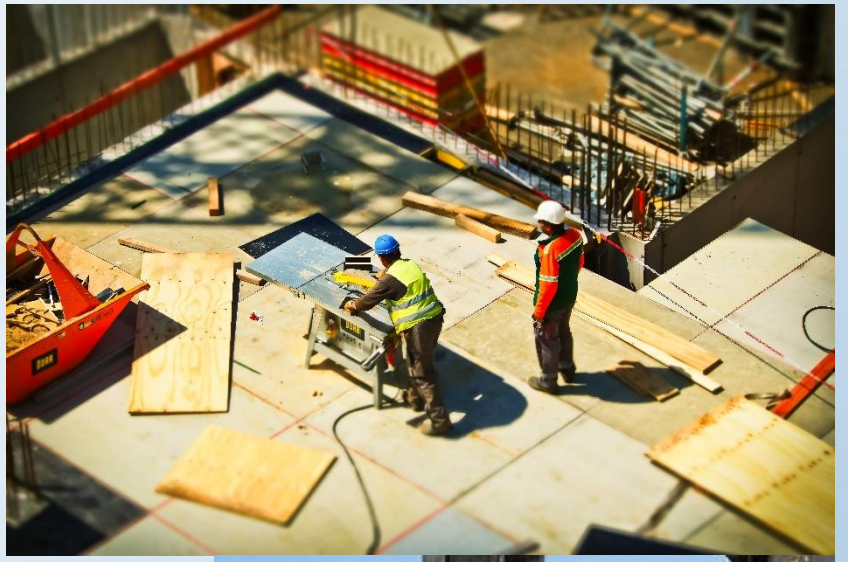


Load bearing wall



• Applications of Construction Engineering

- Constructing substructure and superstructure according to IS codes.
- To apply modern techniques and machinery for safe and speedy construction.
- Selecting proper methods, processes and techniques for achieving good quality of construction.
- Using appropriate materials and of right quality and quantity.
- Ensuring desired strength , stability and durability of constructions.
- Monitoring the workmanship (actual methods and stages of construction).



3. Fluid Mechanics

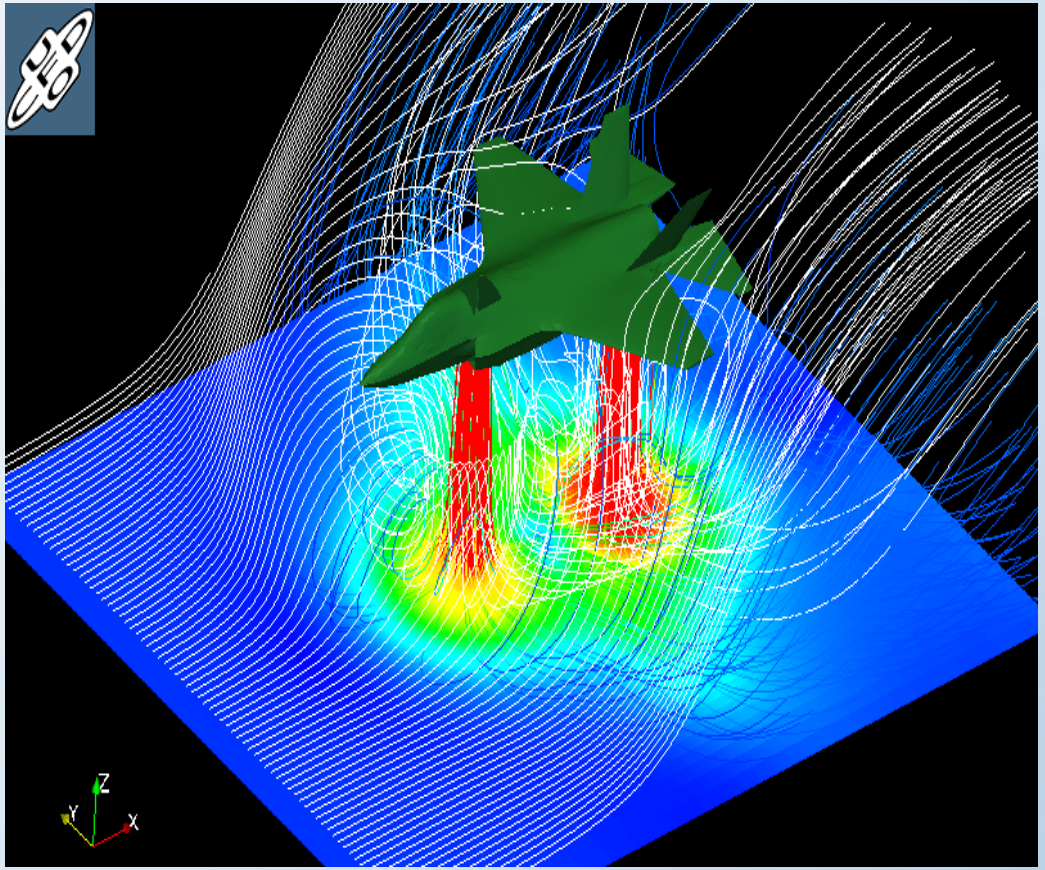
Definition : It is a branch or basic area of civil engineering which deals with the study and behavior of the fluids such as liquids and gases at rest or in motion.

Fluid Mechanics

- **Fluid Statics**
- **Fluid Dynamics**
  - **Fluid kinetics** (Fluids in motion considering forces in motion)
  - **Fluid kinematics** (without considering the forces causing motion)

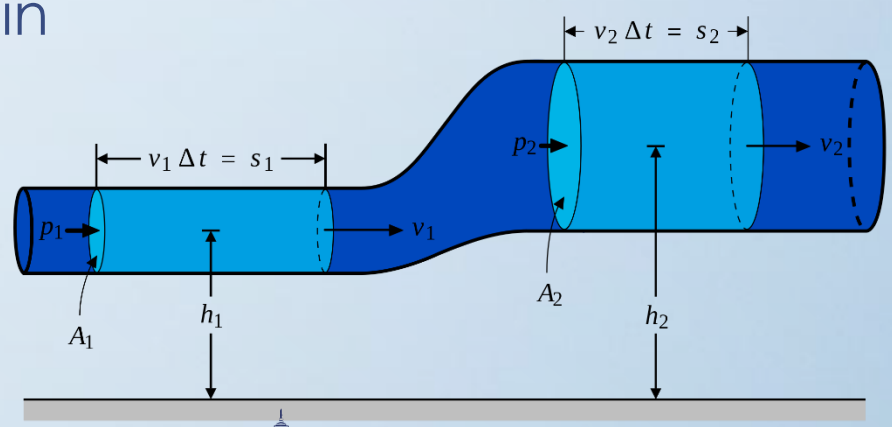
• Examples of FM

- Flow through pipes and canals
- Flow through pumps and turbines
- Flow blood in veins of the body
- Drag and lift forces experienced by bodies moving in air



• Applications of Fluid Mechanics

- Design of dams regulation of canals and water reservoirs
- Design of gates which are used to control the floodwater
- Design of spillways, irrigation channels and flow through pipes
- Dimensional less analysis and model studies help in solving complex problems
- Design of hydraulic machines such as centrifugal pumps, reciprocating pumps and turbines
- Used in Irrigation engineering, Chemical engineering, Naval engineering, Aeronautical engineering, Environmental engineering.



4. Transportation engineering

Definition : It is a branch or basic area of civil engineering which deals with design, development, construction and maintenance of roadways, railways , airports, harbors, docks, tunnels and bridges.

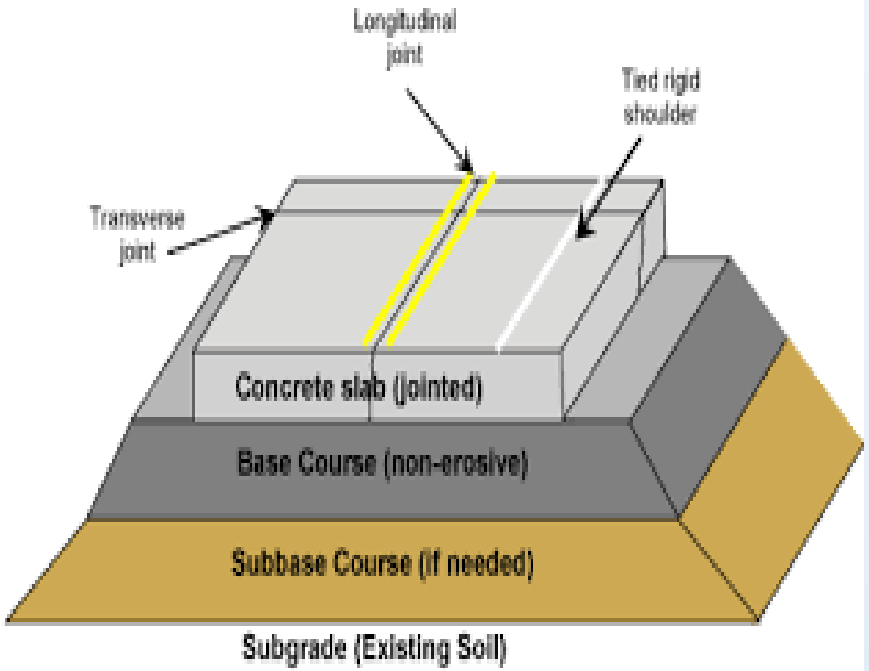
Roads: According to Location

- Expressway (15 m)
- National highway (7m to 15m)
- State Highway (7m to 10m)
- District road (5m to 8m)
- Village road

Classification of roads Based on Materials

- Earthen roads
- Water bound Macadam road (W.B.M.)
- Bituminous or Tar roads
- Cement Concrete roads

• Cement Concrete Road



Types of pavements

Flexible pavement	Rigid pavement
Earthen, gravel, water bound macadam and bituminous roads	Cement concrete roads
Top surface takes to shape of the sub-surface soil	Rigid pavement have more stiffness and capacity to bridge over loose soil pockets in the sub-grade
Due to flexibility, there are ups and downs on WBM roads and bituminous roads	Due to more stiffness and thickness, there are no ups and downs on concrete roads
Initial construction cost is less but Maintenance cost is more.	Initial construction cost is more but Maintenance cost is less.
Less durable.	More durable.

• Railways:

- Mass transportation and for long distances
- Cheapest means of transportation of goods
- Railway is also termed as "Permanent way".

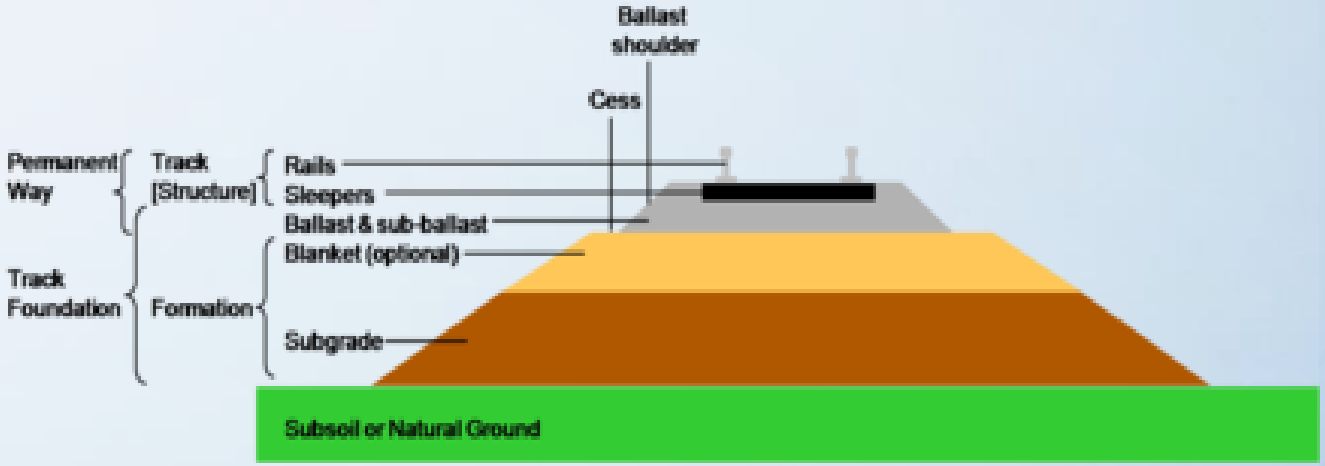
Gauges :A clear distance between inner faces of rail is termed as 'gauge' of track.

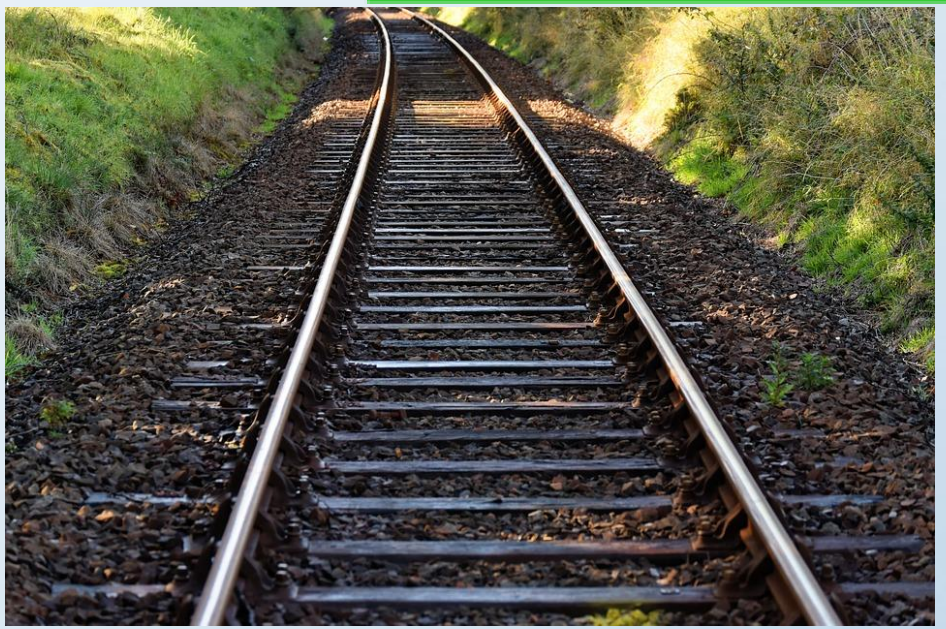
Gauges	Clear distance between the inner faces
Narrow	0.765 m
Meter	1.000 m
Broad	1.676 m

Typical Cross Section of Railways

Parts:

- steel rails
- wooden or precast concrete sleepers
- ballast (crushed stones and metals)
- sub grade(compacted soil underneath the ballast)





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- # Comparison between roadways and railways

Particulars	Roads	Railways
Service	Door to door	Station to Station
Distance	Suitable for any distance	Long distance
Speed	Low or medium	Higher speed
Load carrying capacity	Less	More
Right of entry	Any automobile	Only trains
Operational Control	No such major control	Signaling and interlocking o f rails
Accident rate	more	Less
Maintenance	Less	More than roads

- **Indian railways are divided into nine zones**

a) Central railways
b) Eastern railways
c) Western railways
d) North – Eastern railways
e) Southern railways
f) South – Central railways
g) South – Eastern railways
h) North – Eastern railways
i) North – east frontier zone

• Application :

- Easy and quick transportation of labor, machines, animals and goods
- Remote areas and rural areas become accessible and communicable
- During emergency e.g. wars quick and easy transportation of soldiers, food and ammunition
- Transportation through airways used to connect remote areas and different countries.
- Airways are useful in difficulties during floods e.g. helicopter, airplanes .

5.Irrigation Engineering

Definition : It is a branch or basic area of civil engineering which deals with the development of water sources and proper arrangement of distribution of water from the source developed.

- Irrigation engineering is used for the purpose of cultivation of crop and for drinking and industrial use
- The water source is developed by construction of dam on a river.
- Ground water storage can be developed

• Application

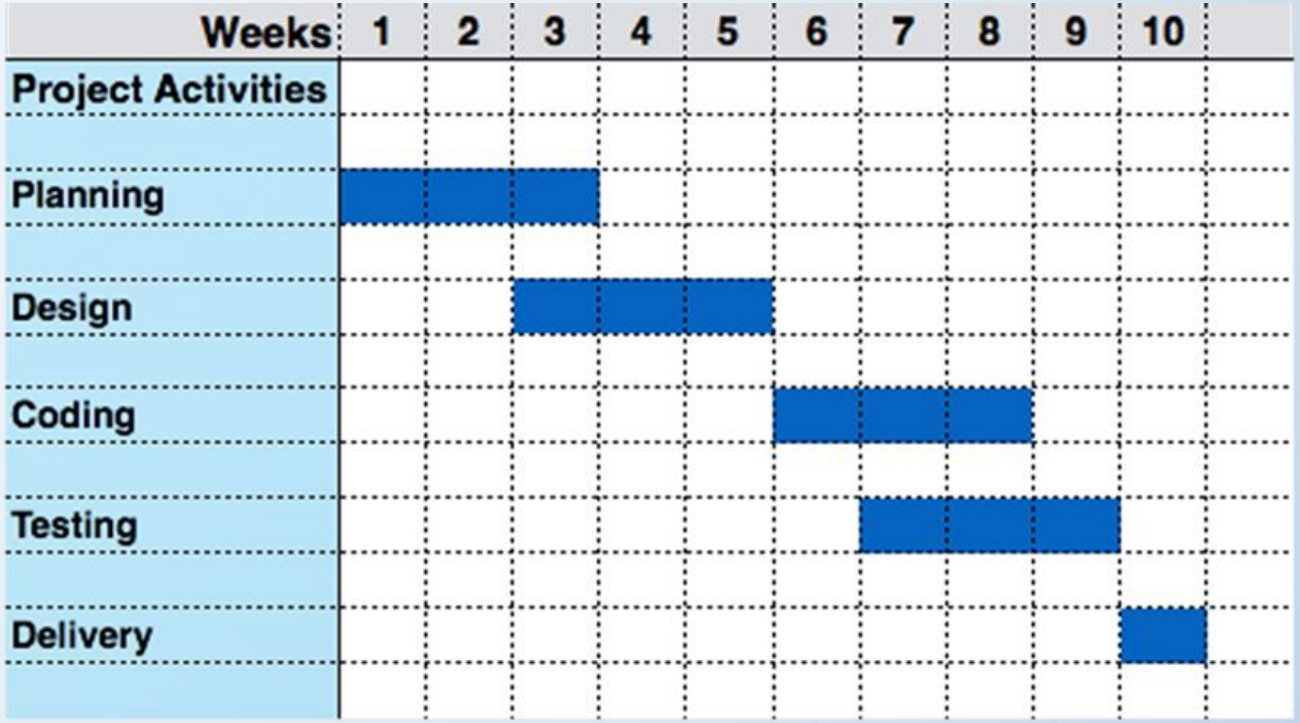
- Development of water resource at the right place
- Determines the reservoir capacity
- Ensures water supply
- Construction and maintenance of dams, canals, and regulatory works for supply of water
- Crop rotation can be done effectively
- New techniques such as sprinkler irrigation and drip irrigation
- To study flood control devices
- Helps to study the design of different structures such as spillways, weirs and canals

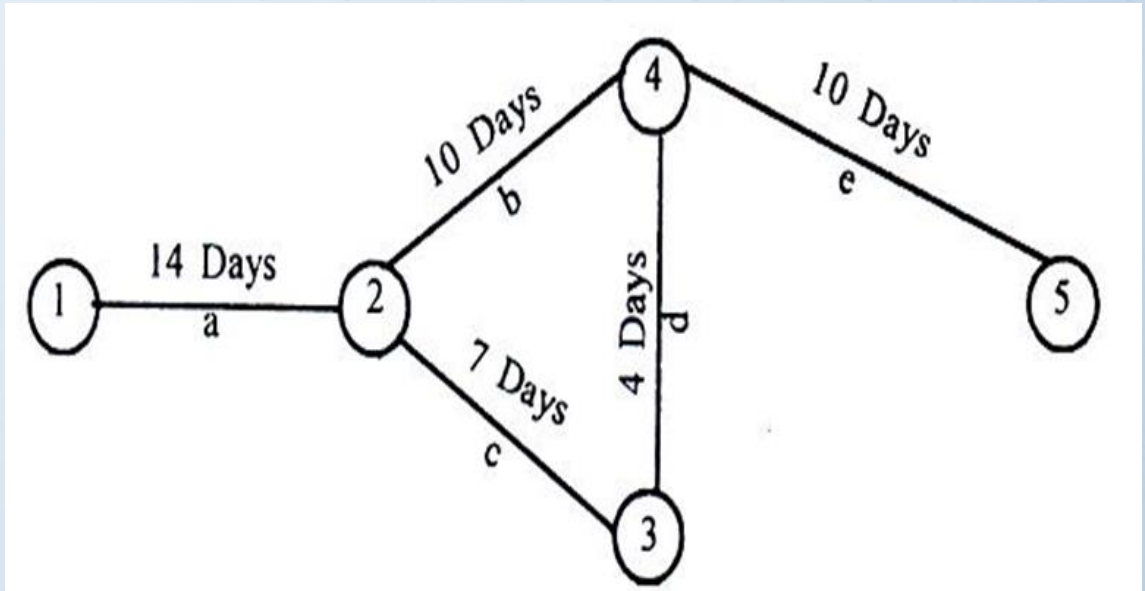
6. Project Management

Definition : It is a branch or basic area of civil engineering which deals with monitoring the project using management principles.

- Civil Engineering projects involves 4 ‘M’ s and time.
- Project manager plans every activity in connection with site say procurement of material, site layout, requirement of labor, schedules of starting, finishing and sequencing of construction activities.

- If the project is finished within time, then generally the expenditure is also with in proposed estimate
- Therefore the project manager uses tools **like bar-chart, Critical Path Method(CPM), Project Evaluation and Review Technique(PERT) to plan all activities, their timings and sequences.**





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• Application

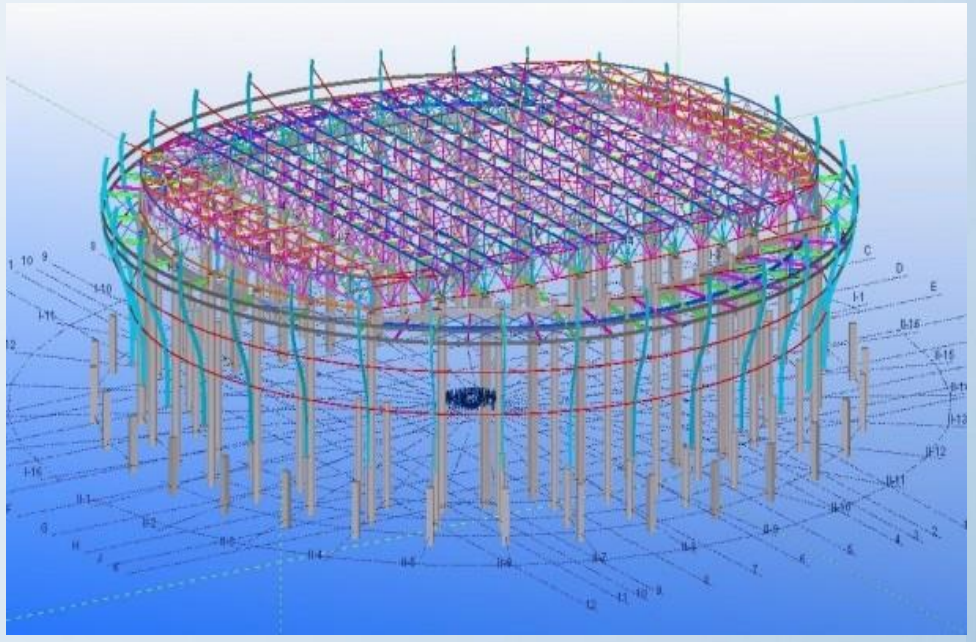
- Overall planning and step by step planning for each activity.
- Optimum and efficient use of various resources required for any project(4M and Time).
- Scheduling and sequencing of activities for completion of projects within allotted budget and planned time.
- Reducing wastage of materials and achieving economy without compromising quality.

7. Structural Engineering

- It deals with designing the structural members(supporting members like columns , beams) and connections for economical and safe design of members as well as the whole structure for different type of load combinations.
- Firstly, it includes calculation of different types of load acting on any structure viz. Dead load, live load, wind effects, seismic force etc.
- It deals with stability and safety of the structures.

• Application

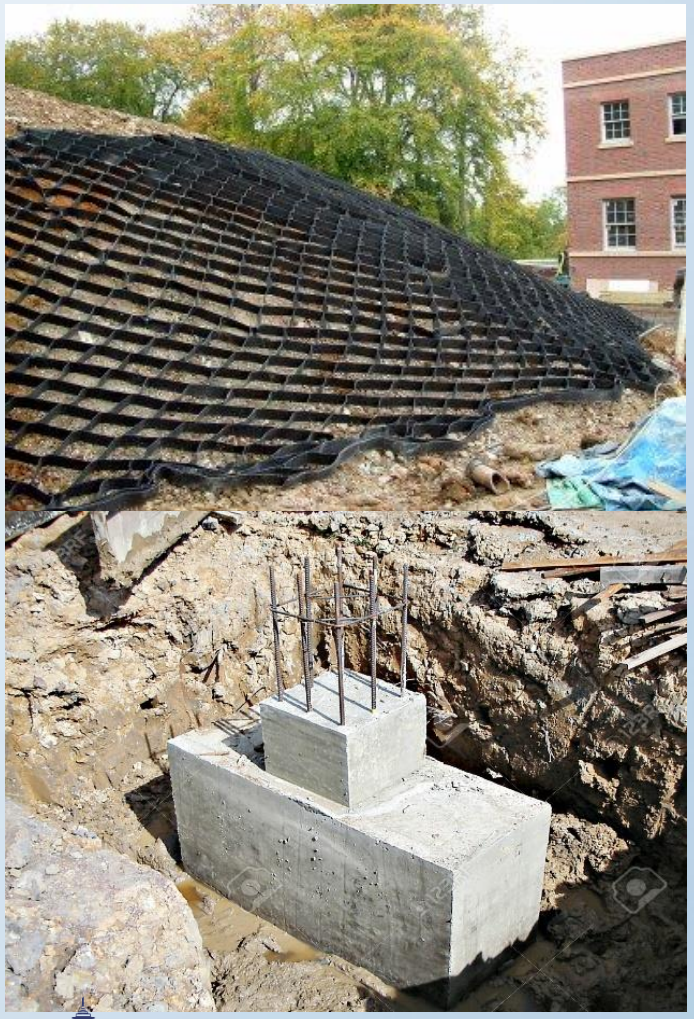
- Design the structural members as well as the structures itself for given loads to ensure safety of structures.
- Design of special type of steel or R.C.C(Reinforced Cement Concrete) structures , bridges, rigid pavements etc.
- To ensure desired factor of safety for members of structures and connections like rivets, bolts etc.
- Analysis of failures of structures.
- Retrofitting and rehabilitation of structures



8. Geotechnical Engineering

Definition : It is a branch or basic area of civil engineering which deals with the study of soil, its behavior on application of load and its application as an engineering material.

- It is also known at Soil Mechanics.
- With the help of geotechnical engineering, bearing capacity of soil can be determined.
- Trial pits
- Plate load test
- It is related to foundation engineering.



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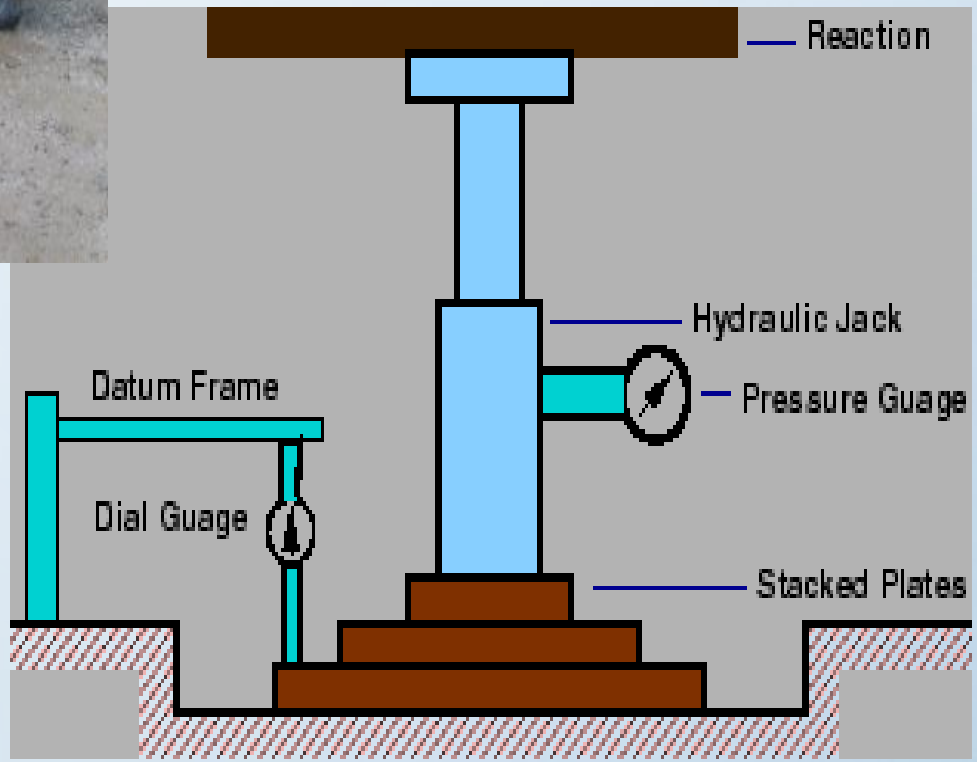

Reaction
Hydraulic Jack
Pressure Guage
Datum Frame
Dial Guage
Stacked Plates

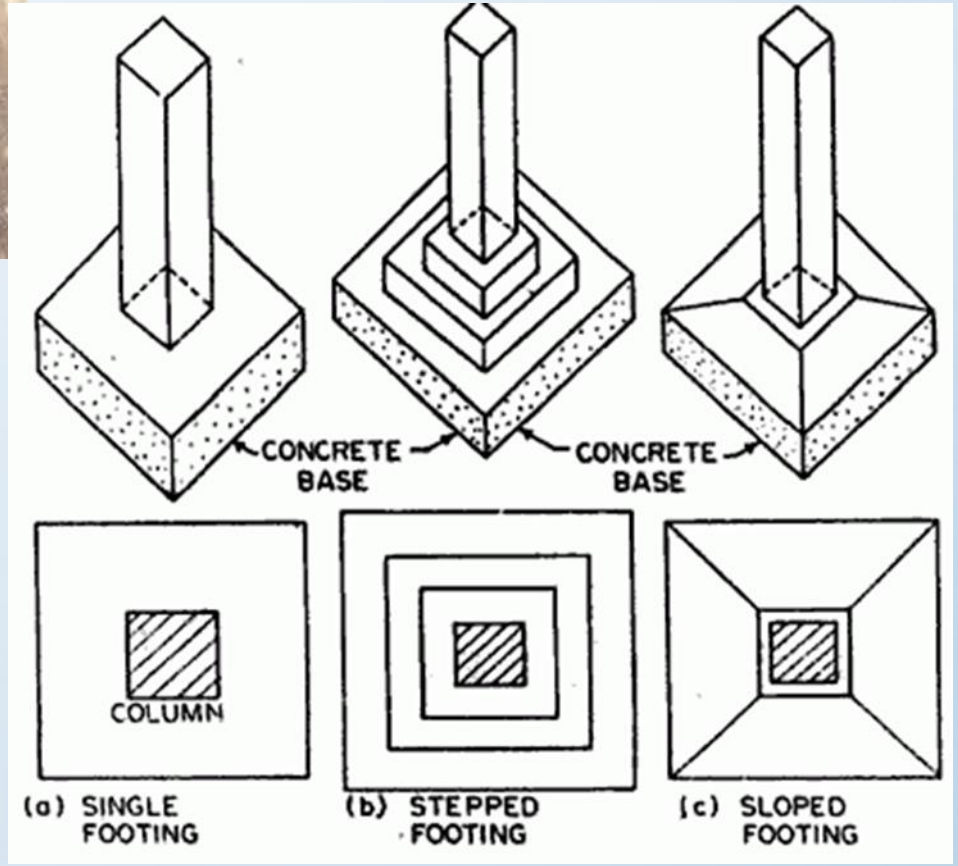
• Application

- Classification of soil can be done by studying soil profile
- Properties and strength characteristics of different types of soils
- Helps to determine the safe bearing capacity of soil
- Intensity of stresses on soil strata at different depths underneath the ground under different loads can be properly studied
- Helps in designing the earthen dam and earthen embankment
- Helps to find the thickness of various layers of pavements
- Characteristics of soil related to permeability, compaction and consolidation can be studied
- Helps to design of different types of foundation for different structures

Foundation Engineering

Definition : It is a branch or basic area of civil engineering which deals with the design, construction, maintenance, renovation of footings, foundation walls, pile foundation and other structural members which acts as foundation of various structures.

Foundation :- it is a part of structure below ground level also called as sub-structure, which directly receive the load of superstructure and transmit it to the soil or hard strata below safely.


CONCRETE BASE
CONCRETE BASE
COLUMN
(a) SINGLE FOOTING
(b) STEPPED FOOTING
(c) SLOPED FOOTING

• Application

- It is helpful to determine the proper type of foundation to be provided. (shallow foundation or deep foundation)
- It helps tin deciding different type of shear failure.
- Helps to determine foundation settlement, settlement rate and suggests to minimize foundation settlement
- Design of foundation under sea and design of the machine foundation
- Helps in solving vibration related problem (earthquake, mining, pile driving, explosions, traffic vibration, machine vibration
- Suggests different methods to protect foundation structure from chemicals attack
- Helps to design of different types of foundation for different structures

8. Geology

Definition : It is an Earth science concerned with the solid Earth, the rocks of which it is composed, and the processes by which they change over time.

- Geology describes the structure of the Earth on and beneath its surface, and the processes that have shaped that structure.
- It also provides tools to determine the relative and absolute ages of rocks found in a given location, and also to describe the histories of those rocks.

• Methods of Geology

- Geologists use a number of field, laboratory, and numerical modeling methods to decipher Earth history and to understand the processes that occur on and inside the Earth.
- In typical geological investigations, geologists use primary information related to petrology (the study of rocks), stratigraphy (the study of sedimentary layers), and structural geology (the study of positions of rock units and their deformation).
- geologists also study modern soils, rivers, landscapes, and glaciers; investigate past and current life and biogeochemical pathways, and use geophysical methods to investigate the subsurface.

1. Field methods
2. Petrology
3. Structural Geology
4. Stratigraphy

- Sub-specialities of geology

1. Distinguish endogenous
2. Exogenous geology.

• Application

- Geology is used in exploration for energy and mineral sources.
- It is useful in finding crude oil and natural gas which is found in sedimentary rock along rifted c ontinental margins and in intracontinental basins.
- It is used in developing variety of applications for geothermal energy.
- It is useful in finding the mineral deposition.
- It is useful in earthquake prediction which is a major concern of seismologists.
- Geologists and geophysicists have led the exploration for fossil fuels (coal, oil, natural gas, etc .) and concentrations of geothermal energy, for which applications have grown in recent ye ars.
- The fields of engineering, environmental, and urban geology are broadly concerned with ap plying the findings of geologic studies to construction engineering and to problems of land us e.
- It is useful in different civil engineering fields like surveying, geotechnical engineering, foundati on engineering, transportation engineering etc.
- It has many application in interdisciplinary branches like petroleum engineering, polymer engi neering, chemical engineering etc.

9. Environmental Engineering

Definition : It is a branch or basic area of civil engineering which deals with water supply, disposal of waste water from domestic and industrial use and environmental pollution control.

IS 3025 (all parts)

Classification : Environmental Engineering

- Water Supply
- Sanitary Engineering
- Environmental Pollution

[A] Water Supply :- sources of water, potable or drinkable or fit for drinking

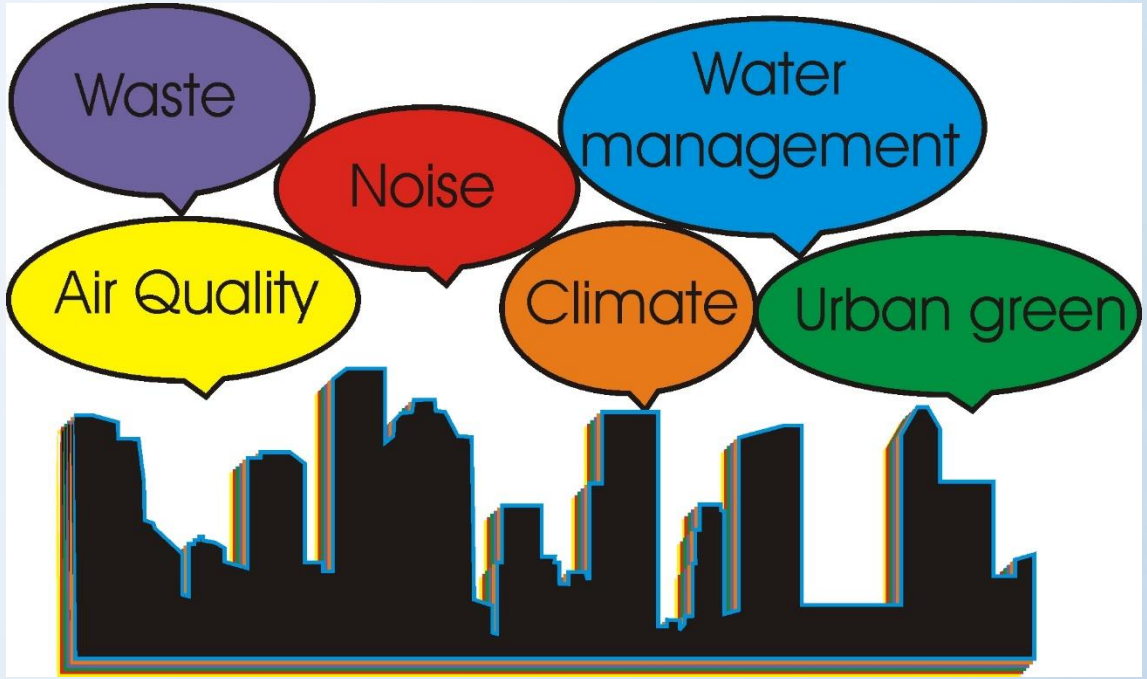
1. Alum in sedimentation tank (turbid or earth particles are removed)
2. It passes through sand filter and chlorine dose is added to kill bacteria.
3. In this way water is treated and made potable and then supplied by the network of pipes to the people

[B] Sanitary Engineering :- it deals with the disposal of waste ad wastewater.

In big cities the waste water is carried away by network of pipelines called **sewers** and treated further and is made harmless.

[C] Environmental Pollution

1. Air Pollution
2. Sound Pollution
3. Land pollution
4. Water pollution



- Pollution is due to deforestation, industrialization, and urbanization
- Effect of pollution is observed on human beings, plants, animals, buildings and building material.
- Preventive and corrective steps are being taken by the government to reduce the pollution

• Application

- To treat the water and make it potable or drinkable
- It deals with the collection of wastewater using pipe network called sewers
- To treat the waste water and make it harmless
- It helps to control pollution to protect human life
- To protect environment by using various measures of pollution control like ESP (Electro Static Precipitator) for dust control, filters for reducing water pollution.
- It provides preventive and corrective steps to reduce different types of pollutions
- Deals with determining impact of any development activity on environment called as **Environmental Impact Assessment (EIA).**
- Deals with collection, transport, treatment and management of solid waste (garbage)

10. Quantity surveying (Estimation)

Definition : It is a branch or basic area of civil engineering which deals with the **measurements of items of construction** and **multiplies it by the present market** rate so as to know the probable cost of the construction.

Before starting any construction work of the structure such as building, road, bridge, dam, tunnel, canal etc a civil engineer always requires to know the probable cost of the construction to achieve the **provision of budget** for the construction.

Estimation:-'Estimate' is a procedure or mathematical method of working out the probable cost of construction based upon the measurement of various items of the construction work.

Valuation :- It is a art of assessing the present fair value of a property. It may change with respect to time.

S.No.	Description of Item	No	Length (L) m	Breadth (B) m	Depth/ Height (D/H)m	Quantity	Explanatory Notes

Measurement sheet

Abstract sheet

Item No.	Description/ Particulars	Quantity	Unit	Rate	Per (Unit)	Amount

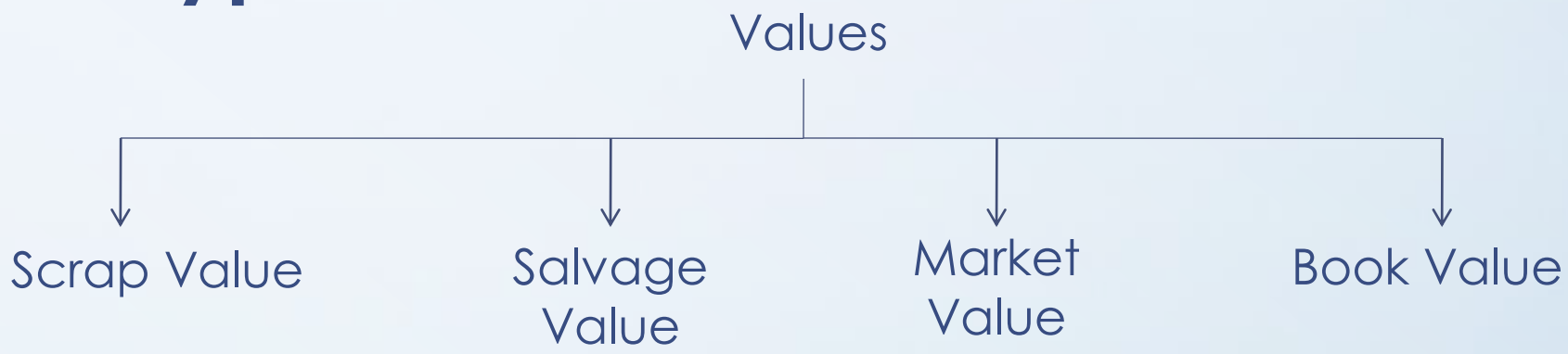
Valuation

Valuation :- It is a art of assessing the present fair value of a property. It may change with respect to time.

Purpose of Valuation

- Buying and selling of property
- Taxation
- Security of loans
- Rent determination'
- Compulsory acquisition
- Speculation
- Private development
- Insurance
- Reinstatement

• Types of Values



Scrap Value :- It is the value of dismantled materials of a property at the end of its utility period.

Salvage Value :- The property after being discarded at the end of utility period, is sold as it is without being broken into pieces and the amount realized, over and above the cost of its removal and sale is known as the salvage value of the property.

Market Value:- It is defined as an amount which can be reasonably realized at any time from the open market when the property is put in the market for sale

Book Value :- It is defined as an amount shown in the account book of a particular year after making due provision for the depreciation of the previous years.

• Application

- Probable cost of the work before construction
- It enables the engineer to know quantities of various items of the building, which can be estimated from plan, section and specifications of the building
- Quantities of material required can be found out. e.g. no of cement bags, steel, bricks, stones, metals etc.
- Engineers can manage the cash flow so that the activities onsite can be well planned accordingly.
- It helps to raise the funds.
- Economical balance of the project can be achieved by the method of Quantity Surveying.
- Useful in Buying and Selling of the properties.
- Used for security of loans.
- Useful to determine the rent and private development.

Estimation	Valuation
It gives the approximate cost of the construction work to be done.	It gives present value of property already constructed.
It consist of finding the quantities, rate analysis and cost of the construction from the working drawing.	It consists of finding the quantities and present value of the property.
Estimated quantities and cost of the construction work is found out by the method of Estimation.	Market value of property to be found out by the method of valuation.
Estimation is helpful to manage the flaw of cash.	Valuation is help to buy or sell the property.
Estimation if helpful to raise the funds from government agencies for big projects	Valuation is useful for rent determination , private development etc.

11. Town Planning

Definition : It is a branch or basic area of civil engineering which deals with the planning aspects and siting of industries in such a way that the natural resources are conserved and utilized in the best possible manner.

- The open spaces to be kept in the cities for various public utility services such as parks, roads, recreational facilities etc. are to be planned well in advance.
- Town planning is an integral aspect of Infrastructure development of an area.
- It helps to reduce illegal construction in the area by formulation Development Control (DC) rules for the specific area.
- As per new government policies government is promoting the development of townships and SEZs (Special Economic Zones) in various states including Maharashtra
- Preparing proper development plans, identification of natural hazards and mitigation plan for the same are integral parts of the same

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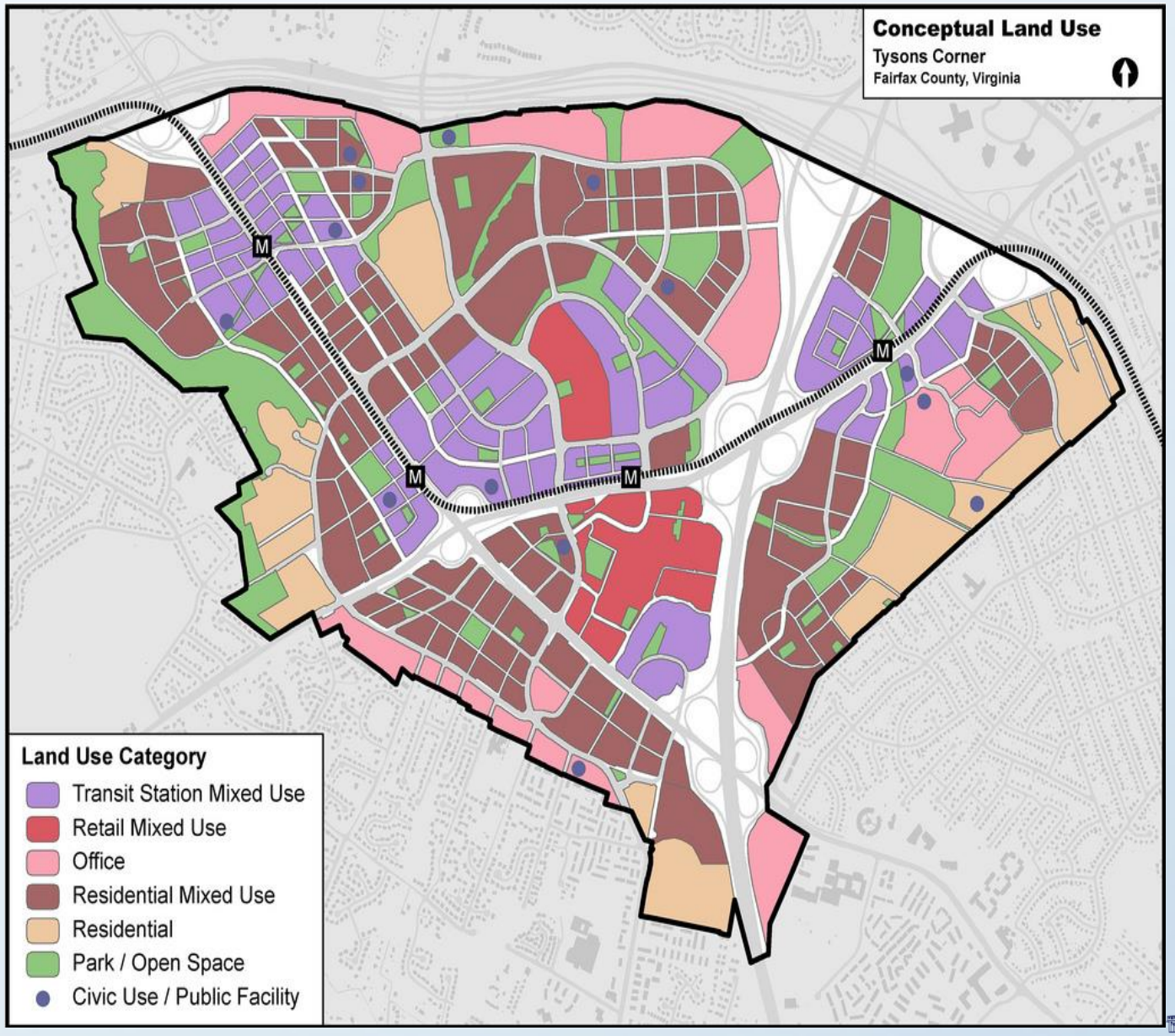
• Principles of Town Planning



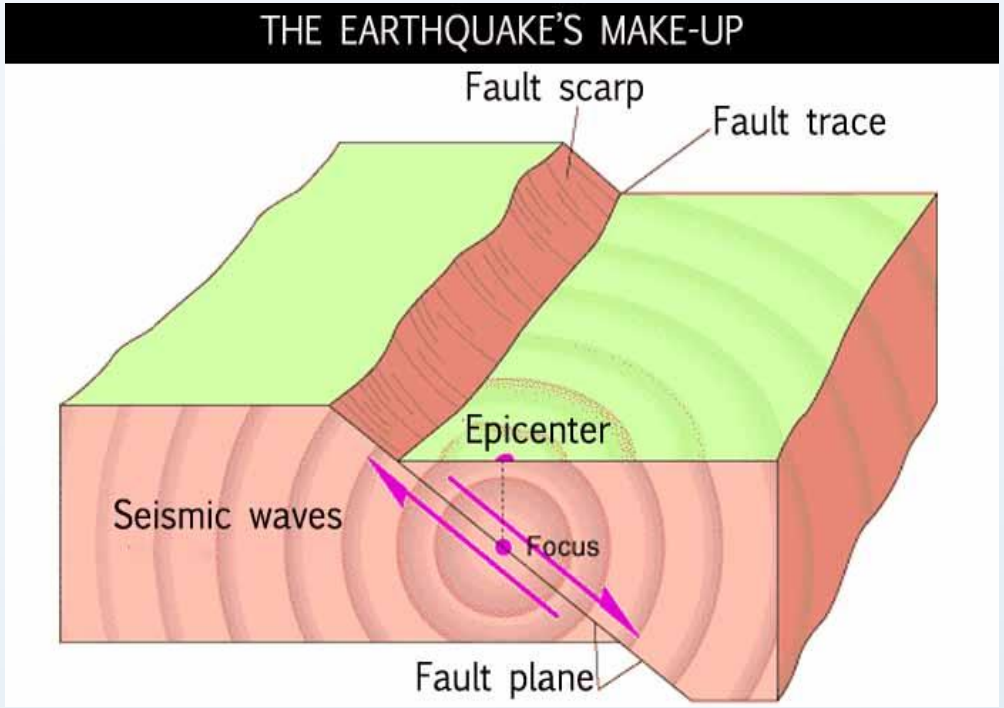
12. Earthquake Engineering

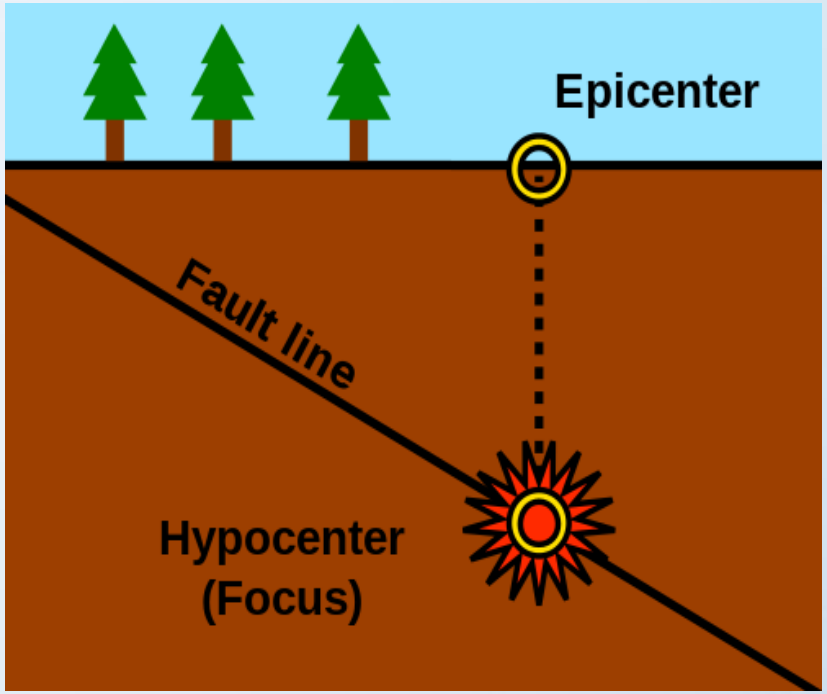
Definition : It is a branch or basic area of civil engineering which deals with the study of zones of probable seismic intensity upon the different area so that any preventive care can be taken against earthquake.

During an earthquake, the ground may move horizontally in any direction and vertically up and down, shifting the building foundation correspondingly.

Hypocenter:- Earthquakes are produced by sudden release of tremendous amounts of energy within the earth by a sudden movement at a point called as "hypocenter".

Epicenter:- The point on the surface of the earth directly above the hypocenter is called "epicenter"

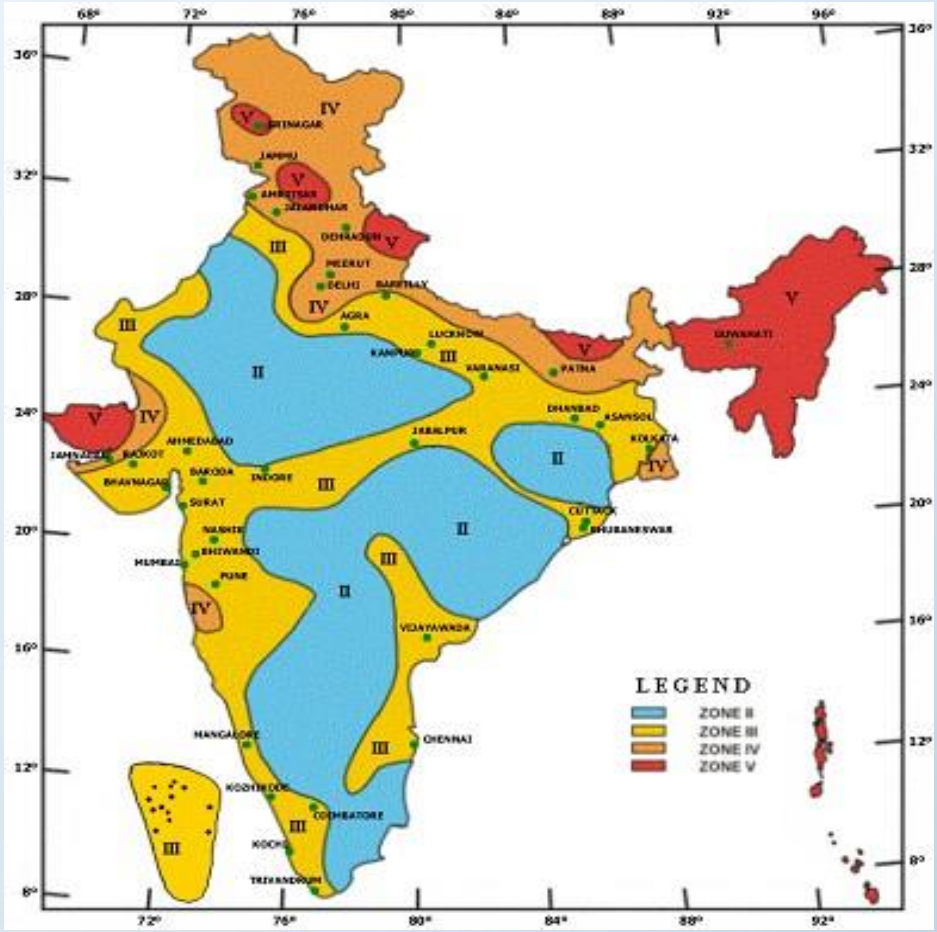




- IS 1893 (Part 1): 2002 'Criteria for Earthquake Resistant Design of Structures : Part 1 General provisions and Buildings'
- IS 1893 (Part 4): 2005 'Criteria for Earthquake Resistant Design of Structures : Part 4 Industrial Structures Including Stack Like Structures'

1. Zone II – Low damage risk zone
2. Zone III – Moderate damage risk zone
3. Zone IV – High damage risk zone
4. Zone V – Very high damage risk zone

- Meteorological Department
- There is vertical and Horizontal waves like motion of the ground in case of Earthquake. Most Destructive Force is in horizontal Direction.



• Applications of Earthquake Engineering

- Design and construction of earthquake resistant foundations and structures.
- Research and development for new materials of construction for better earthquake resistance
- Earthquake studies, monitoring and early warning systems for minimizing the loss of lives, structures and materials.
- Revision of rules, regulations and bylaws for more safety.
- Preparing and revision of seismic –zone map.
- Efficient and safe design of connections and joints of the buildings, structural members etc.
- Newer techniques of construction for effective resistance against the vibrations and dynamic loads due to earthquakes.
- Strengthening the existing structures for seismic loads.

Earthquake Protection:

- A square or a compact rectangular plan should be adopted.
- All parts of a building should be tied together and braced at corners in such a manner that the whole structure will tend to move as a unit.
- Parapets, cornices, cantilevers and projections exceeding 75 cm should be avoided.
- The maximum foundation pressure under dead load and live loads combined with seismic forces shall not exceed by 10% of the normal safe bearing pressure.
- In highly plastic or soft cohesive soils, like silt and some types of clays and very loose cohesion less soil, such as fine sand with very low bearing capacity, the foundation should be carried in a firm stratum by means of piles, piers or wells.
- A raft foundation is designed to with stand load evenly over its whole surface. A raft foundation is designed to withstand load evenly over its whole surface. A raft foundation is more suitable for very high buildings and suitable in very poor soils.
- Building structure can be protected from earthquake by studying zonal map and estimating maximum strength to new and old structure.

13. Infrastructure Development

Definition : It is a branch or basic area of civil engineering which deals with provision of good infrastructure facilities which help to develop the rapid growth of a particular area.

- Provision of tar or concrete road for better communication
- Provision of well planned water supply distribution system
- Provision of a well planned waste water collection system
- Provision of electric power plant
- Provision of in land communication lines i.e. telephone lines
- Provision of proper landscaping within the area under development
- Provision of the open space for garden and playground

Applications/Advantages of Infrastructure Development

- Rapid social and Economic development of the area.
- Planned growth of the area.
- Reduced regional imbalance (between rural & urban area).
- Overall economic growth of areas leading to the advancement of region, state and the country.
- All sectors of economy get boost via services, manufacturing etc. Thus overall employment generation is possible for all people through different types of jobs, activities.

• Example of Infrastructure Development

- MIDC (Maharashtra Industrial Development Corporation) IT Park near Pune.
- Development of New Mumbai or Vashi Area
- Nigadi Pradhikaran in Pune.
- Balewadi Stadium near Pune.
- Flyovers in Mumbai.

Interdisciplinary approach in engineering

Many projects pertaining to different fields required engineers of different branches.

- Mechanical Engineering,
- Electrical Engineering,
- Chemical Engineering,
- Electronics and Telecommunication
- Computer Engineering
- Information Technology

Inter disciplinary Projects

- Dams
- Hydroelectric Power Plant
- Traffic Control Systems
- Airport
- Metro rail
- Mining
- Tunnel
- Stadium
- Monorail

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Construction of Dams and hydroelectric power plant

1. Selection of site
2. Survey
3. Catchment area studies – rainfall measurement and collection
4. Geotechnical investigation
5. Reservoir capacity – decide the reservoir capacity according to demand of water, 20 to 30 yrs. growth
6. Hydraulic Design - width, length and height of dam, spillways, energy dissipater, canals
7. Estimate – cost of project, compensation to land owners, helps to raise funds
8. Planning and design of hydro – electric power plant – planning and designing and construction, with help of civil engineer, electrical engineer, mechanical engineer
9. Socio – economic role – land evacuation, rehabilitation of people, social economical and political aspects
10. Structural design – foundation, retaining wall and spillway
11. Construction and execution
12. Testing - soil, construction material as I.S. requirement

• Power generation projects

- Design of turbines, Maintenance of construction equipments, Fabrication : mechanical engineer
- Design of transformers and electricity distribution system : electrical engineer
- Hydraulic and geotechnical instruments : Instrumentation engineer
- Design of control panel, process automation : Electronics engineer
- Design software : computer engineer
- Information technologist

• Expressway construction

- Maintenance of construction equipments : mechanical engineer
- Exhaust system in tunnels, street lighting, tunnel lighting : electrical engineer
- Design of software : computer engineer
- Designing layout of underground internet cables, telephone lines : telecommunication engineer

Exercise based on module 1

- Shortly brief the role of an engineer in national development.

Thank you

Dr. Vishwanath Karad
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