

GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER-I & II PAPER SOLUTION – SUMMER 2024
Subject Code:3110004
Subject Name: Basic Civil Engineering

Marks

Q.1 (a) Explain role of Civil engineers.

03

Answer:

Civil engineers play a vital role in the planning, design, construction, and maintenance of infrastructure. Their key roles are:

1. **Design and Planning:**
Civil engineers design structures such as buildings, bridges, roads, dams, and water supply systems by considering strength, safety, and economy.
2. **Construction Supervision:**
They supervise construction activities to ensure that the work is carried out as per design specifications, codes, and quality standards.
3. **Infrastructure Development:**
They are responsible for the development and improvement of public infrastructure like highways, railways, airports, and drainage systems.
4. **Environmental Protection:**
Civil engineers work on projects related to pollution control, waste management, and sustainable development to protect the environment.
5. **Project Management:**
They manage resources, manpower, and cost to complete projects within time and budget.
6. **Safety Assurance:**
They ensure that the structures are safe and stable under different loads and environmental conditions

(b) Discuss various grades of Concrete.

04

Answer:

The **grade of concrete** indicates the **strength and composition** of concrete. It is represented by the letter ‘**M**’ followed by a number (e.g., M20), where:

- ‘**M**’ stands for **Mix**
- The **number** indicates the **characteristic compressive strength** of concrete in N/mm^2 after **28 days of curing**.

Types of Concrete Grades:

1. **Ordinary Concrete Grades (for general construction):**
 - **M5, M7.5, M10, M15, M20**
 - Used in **non-structural and low-load bearing works** like pathways, leveling course, etc.
 - Example:
 - M15 = 1:2:4 (Cement : Sand : Coarse Aggregate)
2. **Standard Concrete Grades (for structural works):**
 - **M25, M30, M35, M40**
 - Used in **reinforced concrete structures** like beams, slabs, and columns.
 - Provides moderate to high strength.

3. **High-Strength Concrete Grades:**
 - **M45, M50, M60, and above**
 - Used in **high-rise buildings, bridges, and industrial structures.**
 - Designed with specific properties for durability and strength.

(c) What are the key components of GIS? Describe them briefly.

07

Answer:

GIS (Geographic Information System) is a computer-based tool used to capture, store, analyze, manage, and display spatial or geographical data. It helps in decision-making related to land use, infrastructure planning, resource management, and environmental studies.

The key components of GIS are:

1. **Hardware:**

Hardware refers to the physical components of the computer system on which GIS software operates. This includes high-performance computers, servers, monitors, printers, plotters, GPS devices, and scanners used for data collection, analysis, and output.

2. **Software:**

GIS software provides the tools and functions required to store, analyze, and visualize spatial data. Examples of GIS software include ArcGIS, QGIS, and GRASS GIS. These programs support data entry, editing, query, analysis, and map generation.

3. **Data:**

Data is the core of any GIS. It is categorized into two types:

- **Spatial Data:** Refers to the geographical representation of features such as roads, rivers, buildings, etc.
- **Attribute Data:** Provides descriptive information about spatial features, such as the name of a road, population of a city, or height of a mountain.

4. **People:**

Skilled personnel such as GIS analysts, surveyors, engineers, and planners who collect, analyze, and interpret data are essential to a GIS. Their expertise ensures the effective use and management of the system.

5. **Methods (or Procedures):**

These are the techniques, models, and guidelines followed for data collection, processing, analysis, and presentation. Standardized procedures ensure accuracy, consistency, and reliability of results in GIS applications.

Conclusion:

All five components—**hardware, software, data, people, and methods**—work together to make GIS a powerful tool for spatial analysis and decision-making in various civil engineering projects.

Q.2 (a) Define the following terms: a) Mean Sea Level b) Level Surface c) Bench Mark

03

Answer:

a) Mean Sea Level (MSL):

Mean Sea Level is the average height of the sea surface taken over a long period of time, used as a standard reference for measuring elevations. In India,

it is measured at the Mumbai (formerly Bombay) port.

b) Level Surface:

A level surface is a curved surface that is everywhere at a constant distance from the center of the Earth. It is perpendicular to the direction of gravity at all points and is considered horizontal in surveying.

c) Bench Mark (BM):

A Bench Mark is a fixed reference point of known elevation above Mean Sea Level. It is used as a starting point for leveling work. Bench marks may be permanent (established by Survey of India) or temporary.

(b) Explain site plan and key plan.

04

Answer:

1. Site Plan:

- A **site plan** is a large-scale drawing that shows the detailed layout of the entire site where a proposed building or project is to be constructed.
- It includes:
 - Boundaries and dimensions of the plot.
 - Position of buildings, roads, parking, pathways, and open spaces.
 - Drainage lines, water supply, and utility services.
 - Orientation with respect to North direction.
- It is usually drawn to a **larger scale** like **1:200** or **1:500**.
- It is essential for **municipal approval** and **construction planning**.

2. Key Plan:

- A **key plan** is a small-scale drawing that shows the **location of the project site** in relation to its **surroundings**.
- It helps to identify the site with respect to nearby roads, towns, landmarks, or natural features.
- It includes:
 - Major roads and junctions.
 - Nearby cities, rivers, railway stations, etc.
- It is drawn to a **smaller scale** like **1:10,000** or **1:50,000**.
- It is mainly used for **reference** and is usually placed on the corner of the drawing sheet.

(c) Discuss various pipes used in the house drainage plumbing system.

07

Answer:

In a house drainage plumbing system, different types of pipes are used to carry waste water, soil, and rainwater away from the building in a safe and hygienic manner. Each type of pipe serves a specific function in the overall drainage system.

The various types of pipes commonly used are:

1. Soil Pipe:

- Carries **discharge from water closets (toilets)** and urinals.
- Transports human waste.
- Usually made of **Cast Iron (CI)**, **uPVC**, or **HDPE**.
- Connected directly to the **sewer line** or **septic tank**.

2. Waste Water Pipe:

- Carries waste water from **baths, sinks, kitchen, washbasins**, etc.
- Does **not carry human waste**.

- Usually made of **PVC, CI, or asbestos cement**.
 - Discharges into the **manhole or gully trap**.
-

3. Vent Pipe:

- Provides **ventilation** to the drainage system to release foul gases.
 - Prevents the **build-up of pressure or vacuum** in the pipes.
 - Extends **above roof level**, open at the top.
 - Does **not carry any waste or water**.
 - Made of **CI or PVC**.
-

4. Rainwater Pipe:

- Also called **down-take pipe** or **roof drain pipe**.
 - Carries **rainwater** from roof gutters to ground level or stormwater drain.
 - Generally made of **PVC, GI, or asbestos cement**.
 - Should be separate from waste water and soil pipes.
-

5. Anti-Siphonage Pipe:

- Prevents **siphoning action** which may suck water out of traps.
 - Connected between the trap and the vent pipe.
 - Maintains the **water seal** in traps to block foul smells.
 - Usually made of **PVC or CI**.
-

Conclusion:

An efficient house drainage system requires proper selection and installation of different pipes such as **soil pipes, waste pipes, vent pipes, rainwater pipes, and anti-siphonage pipes**. Each plays a crucial role in ensuring a **safe, hygienic, and odor-free** environment inside the building.

OR

- (c) Draw a detailed sketch of a cross section of a wall showing the components of the building. 07
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Answer:

A cross-sectional view of a wall illustrates the **vertical arrangement** of different structural and non-structural components of a building from the **foundation to the roof**. It helps in understanding the placement and purpose of each part of the building.

Key Components Shown in the Cross-Section:

1. **Foundation (Footing):**
 - Transfers the load of the building to the ground.
 - Usually includes PCC (Plain Cement Concrete) and brick or RCC footing.
2. **Plinth:**
 - The part of the structure between the ground level and floor level.
 - Prevents dampness and entry of insects.
3. **Damp Proof Course (DPC):**
 - A horizontal layer of waterproof material (e.g., bitumen or cement mortar) to prevent moisture from rising.
4. **Wall (Masonry):**
 - Constructed with bricks or blocks.
 - Supports floors and roof.
5. **Flooring:**

- Includes floor finish (tiles, stone, etc.), base concrete, and sub-base.
- 6. **Lintel:**
 - Horizontal support above door and window openings.
 - Usually made of RCC or stone.
- 7. **Roof Slab:**
 - Top covering of the building; made of RCC.
 - Supports waterproofing layer and floor finish on terraces.
- 8. **Weathering Course:**
 - Protective layer on roof to withstand rain and sun.
- 9. **Parapet Wall:**
 - Low wall at the edge of roof slab for safety and aesthetics.
- 10. **Sunshade or Chhajja:**
 - Projection above windows to protect from sunlight and rain.

Q.3 (a) Discuss aims and objectives of Town planning.

03

Answer:

The **aims and objectives of town planning** are as follows:

1. **Proper Land Use:**
To ensure the balanced and efficient use of land for residential, commercial, industrial, and recreational purposes.
2. **Healthy Environment:**
To provide hygienic living conditions by maintaining proper sanitation, drainage, and waste disposal systems.
3. **Traffic and Transportation Management:**
To provide a well-organized road network and transport system to reduce congestion and accidents.
4. **Public Amenities:**
To ensure availability of essential services like water supply, electricity, schools, parks, hospitals, and community centers.
5. **Aesthetic and Social Development:**
To improve the beauty of the town with planned layouts and green spaces and to encourage social interaction.
6. **Future Growth:**
To plan for the future expansion of the town considering population growth and urbanization.

(b) Differentiate between plane survey and geodetic survey.

04

Answer:

Point of Difference	Plane Survey	Geodetic Survey
1. Assumption of Earth's Surface	Earth is considered as a flat surface	Earth is considered as a curved surface (spherical)
2. Area Covered	Suitable for small areas (less than 250 sq. km)	Suitable for large areas (more than 250 sq. km)
3. Accuracy Required	Less accurate, simpler instruments used	High accuracy, uses precise instruments and techniques
4. Curvature Consideration	Curvature of Earth is neglected	Curvature of Earth is taken into account
5. Instruments Used	Chains, tapes, compasses, leveling instruments	Theodolites, GPS, total stations
6. Example	Plot survey, road and canal alignment	National mapping, triangulation surveys

Answer:

Principles of Planning refer to the basic guidelines followed in designing the layout of a building to ensure **comfort, functionality, safety, and aesthetics**. These principles help in achieving maximum utility and efficiency of space.

The various principles of planning are:

1. **Aspect**
 2. **Prospect**
 3. **Privacy**
 4. **Grouping**
 5. **Roominess**
 6. **Circulation**
 7. **Sanitation**
 8. **Flexibility**
 9. **Elegance**
 10. **Economy**
 11. **Furniture Requirements**
-

Explanation of Any Two Principles:

1. Aspect:

- Aspect refers to the **orientation of a room or building** with respect to **sunlight and wind**.
 - The aim is to get **maximum natural light and ventilation**.
 - Example:
 - Living rooms and bedrooms should face **east** to receive morning sunlight.
 - Kitchens are generally placed in the **southeast** corner.
 - Proper aspect improves **comfort, health**, and reduces artificial lighting needs.
-

2. Privacy:

- Privacy means providing **separation between different spaces** to prevent disturbance and maintain personal comfort.
- Types:
 - **Internal privacy** (between rooms of the same house)
 - **External privacy** (from public view or neighbors)
- Example:
 - Bathrooms and bedrooms should not open directly into the living or dining area.
 - Windows should not face neighboring windows directly.

OR

Q.3 (a) Draw traffic signals for (i) No Parking (ii) Over taking prohibited.

03

Answer:

Below are the standard traffic signs as per the **Indian Road Congress (IRC)** guidelines:

(i) No Parking Sign:

- Shape: Circular
- Background: White

- Border: Red
- Symbol: A bold **P** crossed by a red diagonal line
- Meaning: Vehicles are not allowed to park at this location.

(ii) Overtaking Prohibited Sign:

- Shape: Circular
- Background: White
- Border: Red
- Symbol: Two cars — one black (left) and one red (right) — with a diagonal line
- Meaning: Overtaking is not allowed in this zone.

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(b) What are the benefits of Energy efficient building?

04

Answer:

An **energy-efficient building** is designed to use **minimum energy** for heating, cooling, lighting, and other operations without compromising comfort.

Benefits of Energy Efficient Buildings:

1. **Reduced Energy Consumption:**
 - Uses less electricity, gas, or fuel due to better insulation, natural lighting, and ventilation.
 - Leads to significant **cost savings** on energy bills.
2. **Environmental Protection:**
 - Reduces **carbon emissions** and air pollution.
 - Helps in combating **climate change** by using renewable energy sources.
3. **Improved Indoor Comfort:**
 - Maintains stable indoor temperatures and better air quality.
 - Increases the **health and comfort** of occupants.
4. **Long-Term Economic Savings:**
 - Though initial investment may be higher, operational costs are lower.
 - Offers better **value for money** over the building's life cycle.
5. **Enhanced Property Value:**
 - Energy-efficient buildings are in high demand and may have **higher resale value**.
6. **Compliance with Green Building Standards:**
 - Meets requirements of green rating systems like **IGBC, LEED, or GRIHA**.
 - Eligible for **government incentives or tax benefits**.

(c) Describe the various principles of Zoning.

07

Answer:

Zoning is a method of **urban planning** in which a city or municipality is divided into **zones** or sections for **different purposes** such as residential, commercial, industrial, recreational, etc. The purpose of zoning is to **ensure proper use of land**, prevent congestion, reduce conflicts between land uses, and improve the overall quality of life.

Principles of Zoning:

The main principles of zoning are as follows:

1. Segregation of Land Use:

- Different land uses such as **residential, commercial, industrial, and recreational** should be located in **separate zones**.
- This helps prevent **conflicts and disturbances**, e.g., separating noisy factories from peaceful residential areas.

2. Compatibility:

- Land uses within a zone should be **compatible** with each other.
- For example, **schools, parks, and housing** can be in the same residential zone, but **factories should be kept separate**.

3. Accessibility and Transportation:

- Zones should be planned in a way that ensures **easy access** to public transportation, roads, and important services.
- Proper road connectivity between different zones is essential.

4. Flexibility:

- Zoning should be **flexible enough** to accommodate **future expansion**, population growth, and changing needs of the city.
- Provision for **mixed-use development** (e.g., commercial + residential) can be included in modern zoning.

5. Environmental Consideration:

- Sensitive areas like **lakes, forests, and flood-prone zones** should be protected through special environmental zoning.
- Industrial zones should be located **away from residential and water bodies** to reduce pollution.

6. Safety and Health:

- Zoning should ensure **adequate open spaces, setbacks, and ventilation**, which are essential for public health.
- Hazardous industries must be placed in isolated zones to avoid accidents.

7. Uniform Development:

- Encourages **balanced development** across all parts of the city rather than overdevelopment in certain areas.
- Prevents slum formation and overcrowding by **controlling density**.

Conclusion:

Zoning is a vital tool in urban planning that ensures **systematic and healthy development** of towns and cities. By applying these principles, civil engineers and planners can create **functional, sustainable, and livable urban environments**.

Q.4 (a) Differentiate between W.C.B and Q.B system.

03

Answer:

Point of Difference	Whole Circle Bearing (W.C.B)	Quadrantal Bearing (Q.B)
1. Definition	Bearing measured clockwise from the north (0° to 360°).	Bearing measured from either north or south towards east or west (0° to 90°).
2. Direction of Measurement	Always measured in clockwise direction from north.	Measured clockwise or anticlockwise from north or south.
3. Notation	Represented only by angle (e.g., 120°).	Represented with quadrant (e.g., $N30^\circ E$, $S45^\circ W$).
4. Used In	Commonly used in prismatic compass.	Used in surveyor's compass.

	survey.	
5. Maximum Value	360 degrees.	90 degrees.

(b) Write short note on FAR.

04

Answer:

FAR – Floor Area Ratio

- **FAR (Floor Area Ratio)** is the ratio of the **total built-up area** of all floors of a building to the **total plot area** on which the building is constructed.

FAR=Total Floor Area of the Building/Plot Area

- It is also known as **FSI (Floor Space Index)**.
-

Importance of FAR:

1. **Regulates Building Density:**
 - FAR limits how much construction can be done on a plot, helping in **planned urban development**.
 2. **Controls Population Load:**
 - Prevents overcrowding by maintaining a balance between open spaces and built-up areas.
 3. **Guides Building Height and Area:**
 - Higher FAR allows taller or more spread-out buildings.
 4. **Used by Urban Authorities:**
 - FAR values are defined by **municipal or town planning departments**, and vary with the zone (residential, commercial, etc.).
-

Example:

- If a plot is 500 m² and permitted FAR is 1.5, then:
Maximum Built-up Area=500×1.5=750m²

(c) Describe water borne diseases with control measures.

07

Answer:

Water-borne diseases are diseases caused by the consumption of **contaminated water** or by coming into contact with **water containing harmful microorganisms**, such as **bacteria, viruses, or parasites**. These diseases are most commonly spread through **drinking unclean water**, poor sanitation, and improper sewage disposal.

Common Water-Borne Diseases:

1. **Cholera:**
 - Caused by: *Vibrio cholerae* (bacteria)
 - Symptoms: Severe diarrhea, dehydration, vomiting
2. **Typhoid:**
 - Caused by: *Salmonella typhi* (bacteria)
 - Symptoms: Fever, weakness, stomach pain, loss of appetite
3. **Hepatitis A:**
 - Caused by: Hepatitis A virus
 - Symptoms: Jaundice, fatigue, nausea, liver inflammation
4. **Dysentery:**
 - Caused by: *Shigella* or *Entamoeba histolytica*
 - Symptoms: Diarrhea with blood and mucus, abdominal pain

5. Giardiasis:

- Caused by: *Giardia lamblia* (parasite)
- Symptoms: Diarrhea, cramps, bloating

Control Measures:

To prevent the spread of water-borne diseases, the following control measures should be implemented:

1. Safe Water Supply:

- Ensure water is treated by **filtration, sedimentation, chlorination, or boiling**.
- Use of **municipal treated water** for drinking and cooking.

2. Proper Sanitation:

- Dispose of human waste using **septic tanks or sewer systems**.
- Avoid **open defecation** and contamination of water bodies.

3. Hygiene Practices:

- Wash hands with soap after using toilets and before eating.
- Maintain cleanliness in kitchen and food handling areas.

4. Public Health Education:

- Create awareness about **water safety and hygiene**.
- Educate people about **boiling water**, using **ORS (oral rehydration solution)**, and seeking **medical help** in case of symptoms.

5. Regular Monitoring:

- Frequent **testing of water sources** for bacterial contamination.
- Maintain records and take **preventive actions** if contamination is detected.

6. Vector Control:

- Prevent breeding of mosquitoes in stagnant water to avoid **water-related vector diseases** like **malaria and dengue**.

Conclusion:

Water-borne diseases are a major public health issue, especially in areas lacking clean water and sanitation. Proper **treatment of water, sanitation, and awareness** can greatly reduce their occurrence and save lives.

OR

Q.4 (a) Enlist Instruments used in chain surveying

03

Answer:

The following instruments are commonly used in chain surveying:

1. **Chain** – Used to measure horizontal distances on the ground.
2. **Arrows (Chain Pins)** – Used to mark the end of each chain length during measurement.
3. **Ranging Rods** – Used to mark survey stations and for ranging straight lines.
4. **Tape (Steel or Cloth)** – Used for accurate measurements or when chaining is not possible.
5. **Cross Staff** – Used for setting out right angles.
6. **Offset Rods** – Used for measuring short offsets.
7. **Plumb Bob** – Used to transfer points vertically, especially in uneven terrain.

8. **Pegs** – Wooden or iron pegs used to mark station points on the ground.
9. **Field Book** – Used to record measurements and observations during the survey.

(b) Give full form of: a) MH b) FSL c) BBCC d) RCC

04

Answer:

a) MH – Manhole

- An opening constructed in sewer lines or drainage systems to provide **access for inspection, cleaning, and maintenance.**

b) FSL – Full Supply Level

- It refers to the **maximum level** up to which a canal, tank, or reservoir is **designed to be filled** with water.

c) BBCC – Brick Bat Coba Concrete

- A **waterproofing treatment** using broken bricks (brick bats), lime or cement mortar, and concrete, often applied on roofs and terraces.

d) RCC – Reinforced Cement Concrete

- Concrete in which **steel reinforcement bars** (rebars) are embedded to improve **tensile strength**, used widely in structural elements like beams, slabs, and columns.

(c) Describe pillars of smart city.

07

Answer:

A **Smart City** is an urban area that uses **information and communication technology (ICT)** to improve **efficiency, sustainability, governance, and quality of life** for its citizens. The concept is built on several core **pillars** or components that work together to make a city smart, efficient, and sustainable.

The main pillars of a Smart City are:

1. Smart Governance:

- Use of **digital platforms** for government services and public participation.
- Transparent and efficient **e-Governance.**
- Online portals for **grievance redressal**, tax payment, and public feedback.

2. Smart Mobility (Transport):

- Promotes **public transport, non-motorized transport** (bicycles, walking), and **traffic management systems.**
- Use of GPS, traffic sensors, and mobile apps for **real-time updates.**
- Encourages **electric vehicles** and reduces congestion.

3. Smart Environment:

- Focus on **sustainable development, air and water quality monitoring, and green buildings.**
- Efficient **waste management** and **renewable energy** adoption.
- Conservation of **natural resources** and urban greenery.

4. Smart Economy:

- Encourages **innovation, entrepreneurship, and digital business models.**
- Focus on **IT and service-based industries.**
- Skill development and job creation using technology platforms.

5. Smart People:

- Educated and skilled citizens with **digital literacy**.
 - Active **public participation** in governance and decision-making.
 - Inclusive development with attention to **all sections of society**.
-

6. Smart Living:

- Improved quality of life through **healthcare, education, safety, and housing**.
 - 24x7 access to **clean water, electricity, health facilities, and recreation**.
 - Use of **CCTV surveillance**, emergency response, and citizen service centers.
-

7. Smart Infrastructure:

- **Intelligent utility systems** such as smart grids, smart water meters, and sensor-based street lighting.
 - Integrated infrastructure planning for roads, drainage, and public services.
 - Emphasis on **disaster-resilient** and **climate-proof** construction.
-

Conclusion:

The pillars of a Smart City work together to create a city that is **efficient, responsive, inclusive, and sustainable**. These elements help improve urban life and support long-term development while protecting resources and ensuring citizen well-being.

Q.5 (a) Discuss different types of Bearings.

03

Answer:

In surveying, a **bearing** is the horizontal angle between a line and a reference meridian. The different types of bearings are:

1. **True Bearing:**
The horizontal angle measured from the true north (geographical north). It is obtained using astronomical observations.
2. **Magnetic Bearing:**
The angle measured from the magnetic north (as indicated by a magnetic compass). It varies with the earth's magnetic field.
3. **Arbitrary Bearing:**
The angle measured from an arbitrary or assumed meridian (not true or magnetic). It is used when true or magnetic bearings are not required.
4. **Grid Bearing:**
The angle measured with respect to a fixed grid line used in mapping or plane table surveying. It is often used in large-scale maps.

(b) Explain with sketch the use of Line ranger.

04

Answer:

Line Ranger – Explanation:

A **Line Ranger** is a simple **optical instrument** used in **chain surveying** to locate **intermediate points** on a straight line between two survey stations (e.g., points A and B).

It consists of two **right-angled isosceles prisms** mounted together, with reflecting surfaces arranged in such a way that the surveyor can **see both end**

stations simultaneously while standing at the instrument.

Working Principle:

- The surveyor looks through the **prism slit** and adjusts his position until the reflected images of both stations (A and B) appear **in the same straight line**.
 - When both images coincide in a single vertical line, the **point directly beneath the instrument lies on the line AB**.
 - This point is then marked as an **intermediate station**.
-

Use:

- Used to **align intermediate points** quickly and accurately.
- Commonly used in **chain surveying**, especially when no theodolite is available.

(c) Explain various aids and devices used to control and regulate traffic.

07

Answer:

Traffic control devices are essential tools used to **regulate, guide, and control traffic movement** for the safety and efficiency of road users. These aids ensure **orderly flow of vehicles and pedestrians** and help in reducing accidents and congestion.

The major traffic control aids and devices are:

1. Traffic Signs:

- **Regulatory Signs:**
 - Used to **inform road users of laws and regulations**.
 - Example: Stop, No Entry, Speed Limit.
 - **Warning Signs:**
 - Alert drivers to **potential hazards or changes** in road conditions.
 - Example: Curve Ahead, School Zone, Steep Slope.
 - **Informatory Signs:**
 - Provide **guidance and information** about routes, directions, and facilities.
 - Example: Hospital Ahead, Petrol Pump, Parking Area.
-

2. Traffic Signals:

- Use **automated colored lights** to control vehicle and pedestrian movement at intersections.
 - **Standard colors:**
 - **Red:** Stop
 - **Yellow:** Ready (Caution)
 - **Green:** Go
 - Ensures safe and systematic traffic flow at busy junctions.
-

3. Road Markings:

- Painted lines and symbols on the road surface.
 - Functions:
 - Divide lanes
 - Indicate pedestrian crossings
 - Show stopping or parking zones
 - Types: Longitudinal lines, transverse lines, arrows, zebra crossings.
-

4. Road Studs (Cat's Eyes):

- Reflective devices fixed on the road surface.
 - Help in **night-time visibility** and **lane guidance** in low-light conditions.
-

5. Traffic Islands:

- Raised areas placed in the middle of roads or intersections.
- Used to **channelize traffic**, provide **pedestrian refuge**, and reduce vehicle speed.

6. Barriers and Barricades:

- Used during **road construction, maintenance, or temporary diversions**.
- Help restrict entry, slow down vehicles, or change directions.

7. Speed Breakers and Rumble Strips:

- Installed to **reduce vehicle speed** in sensitive zones like schools, hospitals, or residential areas.

OR

Q.5 (a) Describe with sketches characteristics of contours.

03

Answer:

Contours are imaginary lines on the ground that join points of equal elevation. The following are the important **characteristics of contours**:

1. **Contour lines never cross each other:**
Each line represents a specific elevation. Two different elevations cannot meet at a point.
2. **Contour lines close on themselves:**
Either within the map area or outside its boundary. A closed contour indicates a hill or a depression.
3. **Uniformly spaced contour lines indicate uniform slope:**
 - **Closely spaced contours** represent a **steep slope**.
 - **Widely spaced contours** represent a **gentle slope**.
4. **Contour lines form 'V' shapes when crossing a stream or valley:**
The V-shape always points **upstream** or **uphill**.
5. **Contour lines form concentric circles:**
 - Circles with increasing elevation towards the center represent a **hill**.
 - Circles with decreasing elevation towards the center represent a **depression**.

(b) What are the temporary adjustments of Level? How are they done?

04

Answer:

In leveling, **temporary adjustments** are made every time the instrument is set up at a new location. These adjustments ensure the **accuracy of readings** during survey work.

Temporary Adjustments of Level:

There are **three main temporary adjustments** of a leveling instrument:

1. Setting Up the Level:

- The instrument is placed securely on the **tripod stand**.
- Legs of the tripod are adjusted to bring the instrument roughly **level and at a convenient height**.

2. Leveling the Instrument:

- The foot screws are used to make the **bubble tube horizontal**.
- The process is:
 - Turn two screws together to move the bubble to the center.
 - Use the third screw to fine-tune the position.

- The instrument is considered level when the **bubble remains at the center** in all directions.

3. Focusing:

- **Focusing the Eyepiece:**
 - Done by rotating the eyepiece to get a **clear view of the crosshairs.**
- **Focusing the Object:**
 - Adjust the focusing screw until the **staff reading appears sharp and clear.**

These adjustments are essential for **accurate leveling operations** and are performed every time the instrument is shifted.

- (c) The following are the fore bearings of a closed traverse. Calculate back bearings and interior angles of the traverse. 07

Line	F. B
AB	N 45°30' E
BC	S 60°00' E
CD	S 10°30' W
DA	N 75°45' W

Answer:

Given Data (Fore Bearings):

Line F.B.

AB N 45°30' E

BC S 60°00' E

CD S 10°30' W

DA N 75°45' W

Step 1: Calculate Back Bearings (B.B.)

In **Quadrantal Bearing System,**

- B.B. is obtained by **reversing the directions** (i.e., N becomes S and E becomes W, and vice versa)
- **The angle remains the same.**

Line F.B. B.B.

AB N 45°30' E S 45°30' W

BC S 60°00' E N 60°00' W

CD S 10°30' W N 10°30' E

DA N 75°45' W S 75°45' E

Step 2: Calculate Interior Angles

Interior angle at each station = **Angle between the back bearing of incoming line and fore bearing of outgoing line**

→ Use the following rule:

If both bearings lie in different quadrants, add the angles.

If both bearings lie in same quadrant or on same side, subtract smaller from larger.

Result must be **less than or equal to 180°** (interior angle).

Station A:

- Incoming: B.B. of DA = S 75°45' E
- Outgoing: F.B. of AB = N 45°30' E
- Angle between = 75°45' + 45°30' = **121°15'**

Station B:

- Incoming: B.B. of AB = S 45°30' W

- Outgoing: F.B. of BC = S 60°00' E
- Angle between = 60°00' + 45°30' = **105°30'**

Station C:

- Incoming: B.B. of BC = N 60°00' W
- Outgoing: F.B. of CD = S 10°30' W
- Angle between = 60°00' + 10°30' = **70°30'**

Station D:

- Incoming: B.B. of CD = N 10°30' E
- Outgoing: F.B. of DA = N 75°45' W
- Angle between = 75°45' + 10°30' = **86°15'**

Step 3: Check for Error

Sum of interior angles for a **closed traverse (quadrilateral)**:

$$= (n - 2) \times 180^\circ = (4 - 2) \times 180^\circ = \mathbf{360^\circ}$$

Calculated sum:

$$= 121^\circ 15' + 105^\circ 30' + 70^\circ 30' + 86^\circ 15'$$

$$= \mathbf{360^\circ 30'}$$

→ Slight error of 30', which is acceptable in practical field conditions.

Final Answer Summary:

Back Bearings:

Line B.B.

AB S 45°30' W

BC N 60°00' W

CD N 10°30' E

DA S 75°45' E

Interior Angles:

Station Interior Angle

A 121°15'

B 105°30'

C 70°30'

D 86°15'