11	a)	Explain the components of electric vehicles with a neat sketch.	L2	CO2	5 M
	b)	Distinguish between SI engine and CI engine.	L2	CO2	5 M
		UNIT-III			
12	a)	Discuss the working principle of nuclear power plant and mention the advantages and disadvantages.	L2	CO3	5 M
	b)	Explain the importance of belt drives and its types in mechanical power transmission.	L2	CO3	5 M
		OR			
13	a)	Demonstrate the working of hydroelectric power plant and list out the applications.	L2	CO3	5 M
	b)	Categorize the robots and list out the different types of robot configurations.	L2	CO3	5 M

CE 25

PVP 23

Code: 23ES1201

I B.Tech - II Semester – Regular / Supplementary Examinations
MAY 2025

BASIC CIVIL & MECHANICAL ENGINEERING

(Common for CE, ME, IT, AIML, DS)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts: Part-A and Part-B.
2. Each Part contains:
- 5 short answer questions. Each Question carries 1 Mark and
- 3 essay questions with an internal choice from each unit. Each question carries 10 marks.

3. All parts of Question paper must be answered in one place.

BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1.a)	List out any six disciplines of civil engineering.	L1	CO1
1.b)	Write any four construction materials.	L1	CO5
1.c)	Define levelling and state its objectives.	L1	CO2
1.d)	Distinguish the rigid and flexible pavement.	L1	CO3
1.e)	Classify the dams.	L1	CO4

			BL	CO	Max. Marks
		UNIT-I			
2	a)	Discuss about the various types of Aggregates with their sizes and shapes.	L2	CO5	5 M
	b)	Explain the significance of building construction and planning.	L2	CO1	5 M
		OR			

3	a)	Discuss the role of hydraulics and water resources engineering in ensuring better society.	L2	CO1	5 M
	b)	Explain about the prefabricated construction techniques.	L2	CO5	5 M
		UNIT-II			
4	a)	Explain how you would take horizontal measurements using surveying instruments.	L2	CO2	5 M
	b)	Explain about contour and its characteristics (with sketch).	L2	CO2	5 M
		OR			
5	a)	Write about the levelling instruments used in levelling process.	L2	CO2	5 M
	b)	What are the differences between magnetic bearing and true bearing?	L2	CO2	5 M
		UNIT-III			
6	a)	Discuss how the transportation engineering plays an important role in economic development?	L2	CO3	5 M
	b)	Illustrate the hydrological cycle and mention its parts with a neat sketch.	L2	CO4	5 M
		OR			
7	a)	Discuss the components and functions of rigid pavement.	L2	CO3	5 M
	b)	Explain about the quality of water.	L2	CO4	5 M

PART – B

		BL	CO
1.f)	Classify non-ferrous metals.	L1	CO1
1.g)	State the principle of Joining Process.	L1	CO2
1.h)	Define degrees of freedom.	L1	CO3
1.i)	What is the carbon percentage in steel?	L1	CO1
1.j)	What is meant by 2-stroke engine?	L1	CO2

			BL	CO	Max. Marks
		UNIT-I			
8	a)	What is mechanical engineering? Discuss the role of mechanical engineers in the industrial sector and society.	L2	CO1	5 M
	b)	State the applications and advantages of ceramic materials.	L2	CO1	5 M
		OR			
9	a)	Explain the role of mechanical engineer in automotive & aerospace sectors.	L2	CO1	5 M
	b)	Classify and discuss the composite materials in detail.	L2	CO1	5 M
		UNIT-II			
10	a)	Explain any two types of machining process with a neat sketch.	L2	CO2	5 M
	b)	Illustrate the components of Refrigeration & Air Conditioning cycles with a neat sketch.	L2	CO2	5 M
		OR			

I B.Tech- II Semester - Regular Examinations – May 2025

BASIC CIVIL AND MECHANICAL ENGINEERING

Scheme of Valuation for PART-A

1. a) Listing six disciplines of civil engineering – 1 mark
1. b) Listing four construction materials – 1 mark
1. c) Presenting leveling and its objectives – 1 mark
1. d) Distinguish between rigid and flexible pavement – 1 mark
1. e) Classifying dams – 1 mark

2.a) Explanation of various types of aggregates with their sizes and shapes -5Marks
2.b) Explanation of the building construction and planning - 5Marks

3.a) Explanation of hydraulics and water resources engineering - 5Marks
3.b) Explanation of pre-fabricated construction techniques -5marks

4.a) Explanation of horizontal measurements using surveying instruments – 5marks
4. b) Explanation of contour and it's characteristics with sketch – 5marks

5. a) Explanation of levelling instruments used in levelling process – 5marks
5. b) Listing out differences between magnetic bearing and true bearing – 5marks

6. a) Explanation of role of transportation engineering in economic development – 5marks
6.b) Explanation of hydrological cycle with neat sketch – 5marks

7. a) Explanation of components and functions of rigid pavement – 5marks
7.b) Explain about quality of water – 5marks

I B.Tech- I Semester - Regular Examinations –May 2025

BASIC CIVIL AND MECHANICAL ENGINEERING

Key for PART-A

1. a) **Disciplines in civil engineering:**
   - Geotechnical engineering,
   - Transportation engineering,
   - Structural engineering,
   - Water resources engineering,
   - Environmental engineering,
   - Surveying.

1. b) **Construction materials:**
   - Aggregates,
   - Cement,
   - Cement concrete,
   - Steel,
   - Bricks

1. c) **Levelling and objectives:**
   - Elevation measurements involve measurements in vertical plane known as levelling.
   - The objectives are
     1. To determine the elevations of given points with respect to a datum.
     2. To establish the points of required height above or below the datum line.
     3.

1. d) **Note: Any TWO differences listed below can be given 1 mark**

Differences between Flexible payments and Rigid Pavements:

S.No.	Flexible Pavement	Rigid Pavement
1.	It transfers the wheel load to subgrade by grain-to-grain mechanism.	It transfers the wheel load to subgrade by slab action.
2.	The initial construction cost is low.	The initial construction cost is high.
3.	It doesn't require joints.	It requires joints.
4.	Durability is low.	Durability is high.
5.	It doesn't distribute load uniformly. So, a good subgrade is required.	It distributes wheel load uniformly.
6.	There is no effect of temperature variation on stress variation.	Temperature variation affects the stress variation.
7.	The lifespan of flexible pavement is approximately 10 to 15 years.	The maximum lifespan of rigid pavement is approximately 20 to 30 years or more.
8.	Repair work is simple.	Repair work is complex.
9.	The maintenance cost is high.	The maintenance cost is low.
10.	It doesn't require curing.	It requires curing.
11.	Poor night visibility due to the use of asphalt.	Good night visibility due to the use of concrete.
12.	No glare due to sunlight. (Glare: Shine with a solid or dazzling light.)	High glare due to sunlight.
13.	Easy to locate and perform underground works like repairing or locating pipes.	Hard to perform underground works.
14	Its thickness is less.	Its thickness is more.
15.	The bearing capacity of the subgrade influences design.	The bearing capacity of the subgrade doesn't influence its design.
16.	Aggregate and bitumen are used as the key materials.	Concrete and steel are used as key materials.

17.	Stability depends upon the interlocking of aggregates, particle friction, and cohesion.	Stability depends upon joints between the slabs of concrete.
18.	The settlement is permanent. It is not capable of resisting settlement.	It is capable of resisting settlements to some extent.
19.	It is susceptible to heat, oils, greases, and chemicals.	It is highly resistant to heat, oil, greases, and chemicals.
20.	Rolling (Compacting) of the surface is needed.	Rolling (Compacting) of the surface is not needed.
21.	It has a low flexural strength.	It has high flexural strength.
22.	The force of friction is less.	The force of friction is high.

1. e) **Classification of dams based on materials used:**

- Earthfill Dams: Constructed using compacted earth and soil.
- Rockfill Dams: Built with large rock fragments and boulders.
- Concrete Dams: Made of concrete, which can be used for various structural types (gravity, arch, buttress).
- Masonry Dams: Constructed with stone or brick.
- Steel Dams: Constructed with steel.
- Timber Dams: Constructed with timber, often used in temporary or smaller structures.

2. a) **Various types of aggregates with their sizes and shapes:**

Aggregates, used in concrete and asphalt, are classified by size and shape, which significantly impact their use and performance.

- Classification by Size:
    1. Fine Aggregate: Material passing through a 4.75mm sieve, typically natural sand.
    2. Coarse Aggregate: Material retained on a 4.75mm sieve, including gravel and crushed stone.
    3. All-in Aggregate: A mix of both fine and coarse aggregates, naturally occurring.
- Classification by Shape:
    1. Angular: Irregular shapes with sharp edges, offering good interlocking.
    2. Rounded: Naturally weathered particles with smooth edges, found in riverbeds.
    3. Irregular: Intermediate shapes between angular and rounded.

2. b)

Importance of building planning and construction in Civil Engineering:

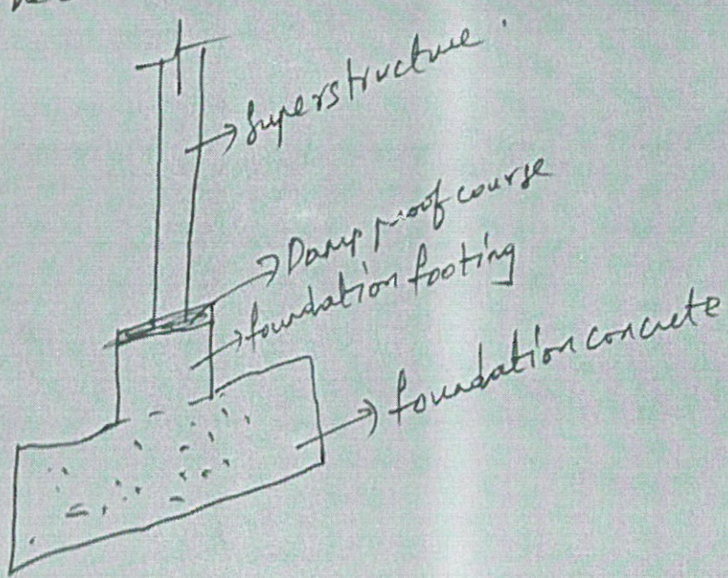
→ A plan is the graphical representation, to some scale, of the feature (i.e., building in our case) on the surface of the earth as projected on a horizontal plane which is represented by plane of the paper on which the plan is drawn.

→ The building construction has been the responsibility of civil engineer. The main considerations in building planning and construction are all as follows:

(i) Climate and its effect.
(ii) People and their requirements.
(iii) Materials for construction and method of construction.
(iv) Bye-laws and Regulations of sanctioning authority.

→ A building has two basic parts: (i) Substructure and (ii) superstructure. A building has following components: 1) foundations, 2) Masonry units: walls & columns, 3) floor structures, 4) roof structures, 5) Doors, windows and other openings, 6) Vertical transportation structures such as stairs, lifts, ramps etc., 8) Building finishes.

→ A figure consisting of structural components in a building can be drawn as follows.



3. a) **Purpose of studying Hydraulics and water resources engineering:**

i) Fluid Mechanics, Hydraulics and Hydraulic Machines: Fluid mechanics deals with the properties and behaviour of fluids at rest or in motion. The principles of fluid mechanics can be applied to daily life as in the case of the flight of planes, the movement of fish in water, and the circulation of blood in the veins.

1. The design of hydraulic structures, such as dams and regulators, require the force exerted by water and the behaviour of water under pressure.
2. Machines which utilize the hydraulic energy are called hydraulic machines. For example, turbines use potential energy of water to generate power. Pumps are devices which utilize mechanical energy to lift water.
3. The efficient working of the above machines depends upon the fluid behaviour whichis dealt with in this discipline.

ii) Irrigation Engineering: Irrigation may be defined as the process of supplying water by man-made methods for the purpose of land cultivation. Irrigation engineering includes the study and design of works related to the control of river water and the drainage of waterlogged areas. Thus, irrigation engineering deals with the controlling and harnessing of various resources of water, by constructing dams, reservoirs, canals, head works and distribution channels to the cultivable land.

3. b) **Pre-fabricated construction techniques:**

Prefabrication is the practice of assembling components of a structure in a factory or other manufacturing site, and transporting complete assemblies or sub-assemblies to the construction site where the structure is to be located. Some researchers refer it to "various materials joined together to form a component of the final installation procedure".

Process and theory:

An example from house-building illustrates the process of prefabrication. The conventionalmethod of building a house is to transport bricks, timber, cement, sand, steel and construction aggregate, etc. to the site, and to construct the house on site from these materials. In prefabricated construction, only the foundations are constructed in this way, while sections of walls, floors and roof are prefabricated (assembled) in a factory (possibly with window anddoor frames included), transported to the site, lifted into place by a crane and bolted together. Prefabrication is used in the manufacture of ships, aircraft and all kinds of vehicles and machines where sections previously assembled at the final point ofmanufacture are assembled elsewhere instead, before being delivered for final assembly.

The theory behind the method is that time and cost is saved if similar construction tasks can begrouped, and assembly line techniques can be employed in prefabrication at a location whereskilled labour is available, while congestion at the assembly site, which wastes time, can be reduced. The method finds application particularly where the structure is composed of repeating units or forms, or where multiple copies of the same basic structure are being constructed. Prefabrication avoids the need to transport so many skilled workers to the construction site, and other restricting conditions such as a lack of power, lack of water, exposure to harsh weather or a hazardous environment are avoided. Against these advantages must be weighed the cost of transporting prefabricated sections and lifting them into position as they will usually be larger, more fragile and more difficult to handle than the materials andcomponents of which they are made.

4. a)

Horizontal linear measurements:

The principle of chain surveying is to divide the area into a number of triangles of suitable sides. A network of triangles is preferred here as triangle is the simple plane geometrical figure which can be plotted with the lengths of its sides alone. Chain surveying is the simplest kind of surveying. The following instruments are required for measurements with chain and tape: Arrows, Pegs, Ranging rods, Offset rods, Plumb bobs and Line ranger

Horizontal angular measurements:

Compass is an instrument which can be used to measure the direction of a survey line with respect to magnetic north-south. The magnetic north-south direction which is the reference direction is called meridian (reference direction) and the angle between the line and the meridian is called bearing. Use of compass for measuring direction of line simplifies the surveying to a great extent.

The types of compass that are used commonly are: (i) prismatic compass; and (ii) surveyor compass. The essential parts of both types are: magnetic needle, graduated circle, line of sight, and box to house them.

In magnetic compass, the graduations are from zero to 360° in clockwise direction when read from top. The direction of north is treated as zero degrees, east as 90°, south as 180° and west as 270°. However, while taking the readings observations are at the other end of line of sight. Hence, the readings are shifted by 180° and graduations are marked as shown in figure 1. The graduations are marked inverted because they are read through a prism.

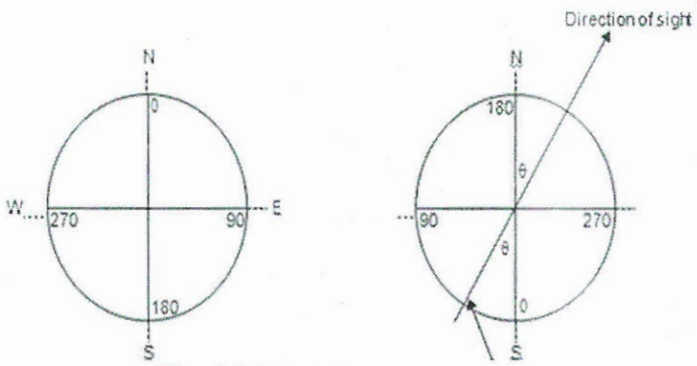


Fig. 1 Magnetic compass

In Surveyors compass graduation disc is fixed to the box and magnetic needle is free to rotate above it. There is no prism provided at viewing end, but has a narrow slit. After fixing the line of sight, the reading is directly taken from the top of the glass cover. Hence, graduations are written directly (not inverted). In this compass graduations are from zero to 90°, zero being to north or south and 90° being to east and west. An angle of 20° to north direction to the east is written as N 20° E, and an angle of 40° to east from south is written as S 40° E. Always first direction indicated is north or south and the last letter indicates east or west direction. In this system graduated circle rotates with line of sight and magnetic needle is always towards north. The reading is taken at the tip of needle. Hence, on the compass east and west are marked interchanged as shown in figure 2.

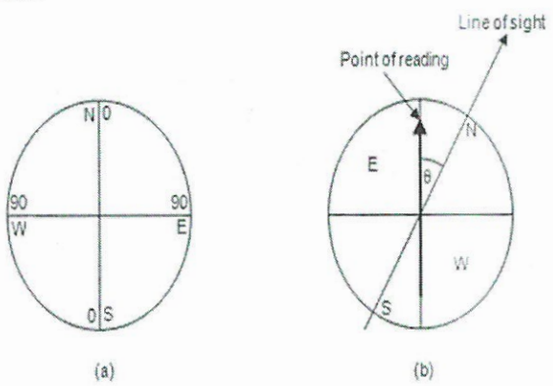


Fig. 2 Surveyors compass

4. b) A contour may be defined as an imaginary line passing through points of equal elevation. A contour interval is the vertical distance between two adjacent contour lines on a map.

Characteristics of contour:

1. Contour lines must close, not necessarily in the limits of the plan.
2. Widely spaced contour indicates flat surface.
3. Closely spaced contour indicates steep ground.
4. Equally spaced contour indicates uniform slope.
5. Irregular contours indicate uneven surface.
6. Approximately concentric closed contours with decreasing values towards centre indicate a pond.
7. Approximately concentric closed contours with increasing values towards centre indicate hills.
8. Contour lines with U-shape with convexity towards lower ground indicate ridge (Fig.1)

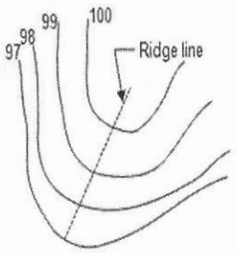


Fig. 1

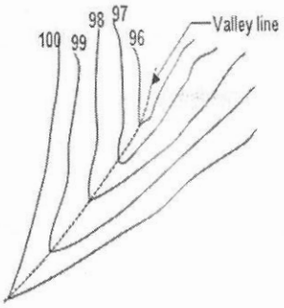


Fig. 2

9. Contour lines with V-shaped with convexity towards higher ground indicate valley (Fig.2).
10. Contour lines generally do not meet or intersect each other.
11. If contour lines are meeting in some portion, it shows existence of a vertical cliff (Fig.3).
12. If contour lines cross each other, it shows existence of overhanging cliffs or a cave (Fig. 5).

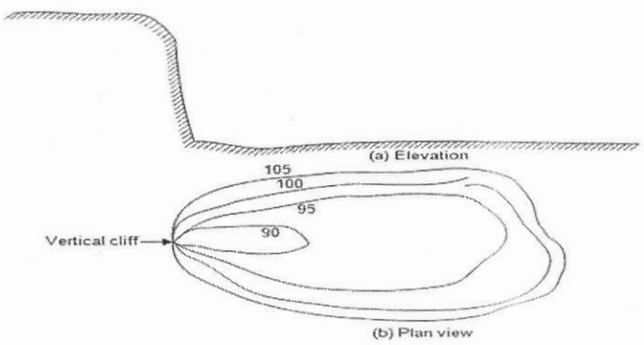


Fig. 3

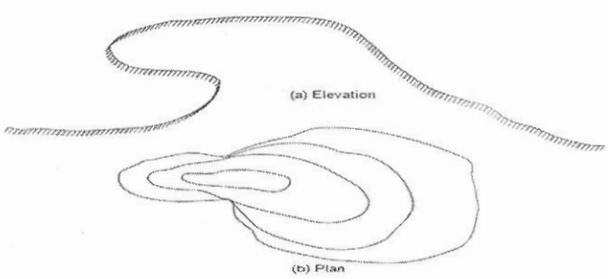


Fig. 4

5. a) **Levelling instruments:**

A level is an instrument giving horizontal line of sight and magnifying the reading at a faraway distance.

- It consists of the following parts:
  1. A telescope to provide a line of sight
  2. A level tube to make the line of sight horizontal and
  3. A levelling head to level the instrument.
- The following types of levels are available:
  (i) Dumpy level (ii) Wye (or, Y) level
  (iii) Cooke's reversible level (iv) Cushing's level
  (v) Tilting level and (vi) Auto level.

5. b) **Differences between magnetic bearing and true bearing:**

- Bearing of a line is the angle made by the line with respect to a reference direction, the reference direction being known as meridian.
- The direction shown by a freely suspended and properly balanced magnetic needle is called **magnetic meridian** and the horizontal angle made by a line with this meridian is known as **magnetic bearing.**
- The points of intersection of earth's axis with surface of the earth are known as geographic north and South Pole. The line passing through geographic north, south and the point on earth is called **true meridian** at that point and the angle made by a line passing through that point is called **true bearing.**

6. a) **Role of transportation engineering in economic development:**

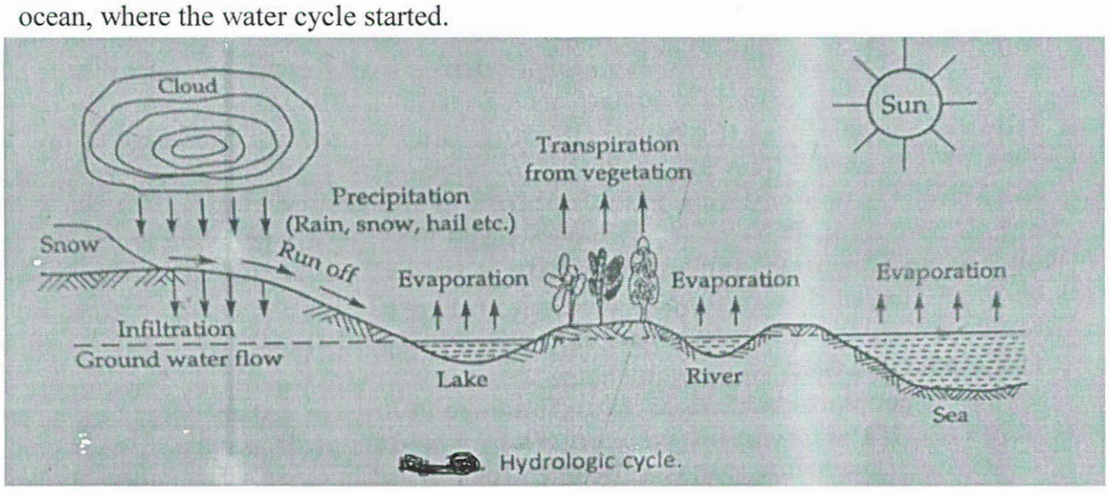
- For rapid economic, industrial and cultural growth of any country, a good system of transportation is very essential.
- Transportation system comprises good network of roads, railways, well-developed waterways and airways.
- Airways and waterways although help to some extent in transportation within the country, these are the primary modes of transport between countries.
- Railways, and highways, also to some extent, help in transport between countries, but their main concern is within the country itself.
- An industrialist has to transport the raw materials and then market his finished products. He can do so efficiently only through a good system of transportation.
- A farmer can market his products to the nearby market economically only through a good system of roads.
- As blood transportation through body arteries is essential for the well-being of the human being, a similar good system of transportation has actually become a measure of country's economic and social development.

6.b) **The hydrological cycle:**

Hydrology is the scientific study of the movement and distribution of water on Earth and other planets, including the water cycle, water resources, and drainage basin sustainability.

The water or hydrological cycle is a continuous natural process that helps in the exchange of water between the atmosphere, the land, the sea, living plants and animals. The water cycle, also known as the hydrological cycle, describes the continuous movement of water on, above and below the surface of the earth. Since the water cycle is truly a 'cycle', there is no beginning or end. Water can change states among liquid, vapour and ice at various places in the water cycle.

The sun, which drives the water cycle, heats the water in the oceans. Water evaporates as vapour into the air. Ice and snow can sublimate directly into water vapour. Rising air currents take the vapour up into the atmosphere where cooler temperatures cause it to condense into clouds. Air currents move clouds around the earth; cloud particles collide, grow and fall out of the sky as precipitation. Some precipitation falls as snow and can accumulate as ice caps and glaciers, which can store frozen water for thousands of years. Snow-packs can thaw and melt, and the melted water flows over the land as snowmelt. Most precipitation falls back into the oceans or onto the land, where the precipitation flows over the ground as surface runoff. A portion of runoff enters the rivers in valleys in the landscape, with stream flow moving water towards the oceans. The runoff and groundwater are stored as freshwater in lakes. Not all runoff flows into rivers. Much of it soaks into the ground as infiltration. Some water infiltrates deep into the ground and replenishes aquifers, which store huge amounts of freshwater for long periods of time. Some infiltration stays close to the land surface and can seep back into surface water bodies (and the ocean) as groundwater discharge. Some groundwater finds openings in the land surface and comes out as freshwater springs. Over time, the water returns to the ocean, where the water cycle started.



Hydrologic cycle.

7. a) **Rigid pavements and its functions:**

Rigid pavements have a great amount of flexural strength or flexural rigidity. In this pavement, the load is distributed by the slab action, and the pavement acts as an elastic plate.

Rigid pavements are constructed by using Portland cement concrete (PCC). The pavement materials are placed either directly on the prepared sub-grade or on a single layer of granular or stabilized surface.

Functions of Rigid Pavement
It transfers the wheel load to subgrade by slab action.
The initial construction cost is high.
It requires joints.
Durability is high.
It distributes wheel load uniformly.
Temperature variation affects the stress variation.
The maximum lifespan of rigid pavement is approximately 20 to 30 years or more.
Repair work is complex.
The maintenance cost is low.
It requires curing.
Good night visibility due to the use of concrete.
High glare due to sunlight.
Hard to perform underground works.
Its thickness is more.
The bearing capacity of the subgrade doesn't influence its design.
Concrete and steel are used as key materials.
Stability depends upon joints between the slabs of concrete.
It is capable of resisting settlements to some extent.
It is highly resistant to heat, oil, greases, and chemicals.
Rolling (Compacting) of the surface is not needed.
It has high flexural strength.
The force of friction is high.

7. b) **Quality of water**:

The aim of water treatment is to produce and maintain water that is hygienically safe, aesthetically attractive and palatable in an economic manner. The method of treatment to be employed depends on the nature of raw water and standard of water quality. The unit operations in water treatment are given below:

1. Aeration
2. Coagulation
3. Flocculation
4. Sedimentation
5. Filtration
6. Softening
7. Disinfection
8. De-mineralisation
9. De-fluoridation