

## **CE6304 SURVEYING I**

### **TWO MARKS**

#### **UNIT-I FUNDAMENTALS AND CHAIN SURVEYING**

**1. Define surveying and list out its various classification. Classify surveying based on instrument used.**

Based on the instruments used and method of surveying, it can be classified as follows.

1. Chain Surveying
2. Compass Surveying
3. Plain Table Surveying
4. Level Surveying (or) Levelling
5. Theodolite Surveying
6. Tacheometric Surveying
7. Total Station Surveying etc.

**2. What is the object of Surveying?**

Following are the various purposes of the surveying methods.

1. To check out the alignment of various engineering structures.
2. To calculate the areas and volumes, involved in the various engineering projects.
3. To prepare the plans and maps, sections (or) profiles, contours, etc.

**3. Write the difference between a map and a plan.**

<b>MAP</b>	<b>PLAN</b>
Maps are the drawing with a small	Plans are also the drawing with larger
A map generally deals about the Geographical details.	A plan deals about the details of the Engineering structures.

**4. What do you mean by plane surveying?**

Plane surveying is defined as the division of surveying, in which all the survey works are carried based on the assumption that the surface of earth is a plane and the curvature of the earth is ignored.

**5. What is meant by geodetic surveying?**

The surveys, in which curvature of the earth is taken into account and higher degree of accuracy, required is called Geodetic surveying.

**6. Name the different ways of Classification of surveying.**

Classification of surveys based on,

- (i) Purpose of surveying
- (ii) Nature of the field
- (iii) Methods employed
- (iv) Instruments used

### **7. What are the principles of Surveying?**

Following are the two fundamental principles of surveying.

- (a) Working from Whole to Part
- (b) Location of a Point

### **8. How do you fix a point from the control points (or a survey line)?**

The position of third point can be located from the control points by any one of the following ways.

1. Two linear measurements
2. Two angular measurements.
3. One linear measurement and one angular measurement.

### **9. What are the instruments used for the chain surveying?**

Following instruments are used in chain surveying

1. Chain 2. Tape 3. Ranging Rods
4. Offset Rods 5. Plumb Bob 6. Pegs
7. Cross-Staff 8. Optical Square 9. Arrows 10. Whites etc.

### **10. Write the equation for correction of temperature.**

Temperature Correction,  $C_t = \alpha (T_m - T_0) L$

Where,

$\alpha$  – Coefficient of thermal expansion

$T_m$  – Mean Temperature during measurements

$T_0$  – Normal Temperature at standardization

$L$  – Measured length of the line

### **11. What are arrows?**

Chain pins (or) Arrows are the steel wire of 4 mm diameter and its length may vary from 25 cm to 50 cm.

One end of the arrow is bent into a loop of a circle of 50 cm diameter and the other end is made sharpened Point. Arrows are used to indicate (or to mark) the end of a chain line.

### **12. What is Plumb Bob?**

Plumb bobs are used to test the verticality of ranging rods and levelling staves. It is also used to transfer the end points of the chain onto ground while measuring the distances in a hilly terrain.

### **13. What is the purpose of an Optical Square?**

Optical Squares are also like cross-staves used for setting out the right angles in chain surveying. It consists of a circular metal box about 5 cm in diameter and 1.25 cm deep. The periphery is formed by two cylinders, one capable of sliding over the other so that the eye and object openings can be closed to protect the mirrors from the dust.

### **14. What do you mean by reciprocal Ranging?**

Reciprocal ranging is the method of indirect ranging, and it is adopted when the two end stations are not inter-visible due to raised grounds.

### **15. What circumstances in which reciprocal ranging is used? (or) When do you require Indirect Ranging?**

Reciprocal ranging is the method of indirect ranging, and it is adopted when the two end stations are not inter-visible due to raised grounds.

### **16. What do you understand by the term traversing?**

Traverse is defined as the series of connected straight lines, each joining two stations on the ground. The endpoints are called traverse stations. The straight lines between the two consecutive stations are called traverse legs.

There are two types of traverse

1. Closed Traverse
2. Open Traverse

### **17. Who are Leader and follower when a line is being chained?**

For the chaining operations, two chainmen are required. The chainman at the forward end of the chain is called a leader. The chainman at the other end of the chain is called a follower.

### **18. In a chain how will you set out a right angle?**

1. Cross-staff is the instrument used to locate the intersection point of a particular offset on a chain line
2. Optical Squares are also like cross-staves used for setting out the right angles in chain surveying.

### **19. Explain the use of traversing?**

Traversing are used,

- ☐ To Fix the points on the ground.
- ☐ To survey when the area is large and with irregular boundaries and obstacles.

### **20. What are offsets? Name the types.**

Offsets are defined as the lateral measurements, taken from the chain line, to locate the position of the boundaries, culverts, building, road markings, etc., An offset may be either left or right of the chain line.

There are two types of offsets, which are

- (i) Perpendicular offset
- (ii) Oblique offset

**21. Differentiate between check line and tie line.**

The line which runs across the field to check the accuracy of the survey work is called check-line (or) proof line.

A tie-line is a one which connects the two tie stations. Sometimes, tie lines are used to check the accuracy of the field work and used to take the offset distances.

**22. Explain the terms accuracy and precision in measurement.**

The degree of accuracy required in surveying is mainly depending on the purpose and scale of the map. If the scale is large, the accuracy will be higher and the accuracy is low for lower scaled maps.

**23. What are different sources of errors in chain surveying?**

- (a) Displacement of the arrows
- (b) Adding (or) Omitting the full chain length
- (c) Reading from the wrong end of the chain
- (d) Reading numbers wrongly
- (e) Reading wrong metre marks
- (f) Recording the reading in the field book wrongly etc.

**24. State the instruments used for setting perpendicular?**

Instruments used for setting perpendiculars are

- (i) Cross staff.
  - a. Open cross staff
  - b. French cross staff
  - c. Adjustable cross staff
- (ii) Optical square.
- (iii) Prism square.
- (iv) Site square.

**25. Define direct ranging?**

When intermediate ranging rods are fixed on a straight line by from end stations, the process is known as direct ranging.

## 26. Differentiate accuracy and precision?

Accuracy is the degree of perfection obtained.

Precision is the degree of perfection used in the instruments.

## 27. Define Traversing?

Traversing is the type of survey, in which a number of connected survey lines form the frame work and the directions and lengths of the survey lines are measured with the help of an angle measuring instrument and a chain or tape

## UNIT II

### COMPASS SURVEYING AND PLANE TABLE SURVEYING

#### 1. Define compass surveying?

The branch of surveying in which direction of survey line are determine by a compass and their length by a chain or tape is called compass surveying. This type of survey can be used to measure large areas with reasonable speed and accuracy.

#### 2. What is a prismatic compass?

Prismatic compass is an instrument used to measure the bearing of a line. It consists of a magnetic needle pivoted at the centre and is free to rotate. The area below the magnetic needle is graduated between 0 to 360 degrees.

The instrument cover consists of a sighting vane and vertical hair to align the compass along the instrument station and the staff station

#### 3. Distinguish between angle and bearing?

**An angle** is defined as the deviation of one straight line with respect to the other one.

**Bearing** is defined as the angle (or) inclination of a survey line with respect to the north-south direction.

#### 4. Define true meridian.

**True meridian** (or) **Geographical meridian** is defined as the line joining the geographical north and south poles. True meridian at various places are not parallel to each other.

#### 5. What is magnetic meridian?

**Magnetic Meridian** is defined as the longitudinal axis, indicated by the freely suspended, properly balanced magnetic needle. It does not coincide with the true meridian except in certain places during the year.

#### 6. Define Local Attraction

The deflection of the magnetic needle from its normal position due to attraction of magnetic materials such as magnetic rocks, iron ores, electrical cables etc., is called Local Attraction.

#### 7. What are sources of local attractions?

Magnetic materials such as magnetic rocks, iron ores, electrical cables etc., are sources of local attractions.

#### 8. If the magnetic bearing of a line AB is $134^{\circ}45'$ , find its true bearing if the magnetic declination is $10^{\circ}15'$ .

True Bearing = Magnetic Bearing + Declination  
 $= 134^{\circ}45' + 10^{\circ}15'$

=  $145^{\circ}$

**9. Define the term Dip.**

The inclination of the magnetic needle with the horizontal plane is called **Dip** (or) **Angle of Dip**. The angle of dip at equator is  $0^{\circ}$  and it increase when approaching the poles. It becomes  $90^{\circ}$  at poles.

**10. What is Magnetic declination?**

**Magnetic Declination** is defined as the horizontal angle between the true north and magnetic north at a place, at the time of observation. The magnetic needle can either be deflecting, towards east (or) west of the true meridian.

**11. Define Declination and Dip in compass surveying?**

The inclination of the magnetic needle with the horizontal plane is called **Dip** (or) **Angle of Dip**. The angle of dip at equator is  $0^{\circ}$  and it increase when approaching the poles. It becomes  $90^{\circ}$  at poles. **Magnetic Declination** is defined as the horizontal angle between the true north and magnetic north at a place, at the time of observation. The magnetic needle can either be deflecting, towards east (or) west of the true meridian.

**12. Differentiate between Magnetic declination and Dip?**

The inclination of the magnetic needle with the horizontal plane is called **Dip** (or) **Angle of Dip**. The angle of dip at equator is  $0^{\circ}$  and it increase when approaching the poles. It becomes  $90^{\circ}$  at poles.

**Magnetic Declination** is defined as the horizontal angle between the true north and magnetic north at a place, at the time of observation. The magnetic needle can either be deflecting, towards east (or) west of the true meridian.

**13. Convert the following WCB into RB (a)  $112^{\circ}04'$  (b)  $339^{\circ}42'$**

(a) RB of  $112^{\circ}04'$

=  $180 - 112^{\circ}04'$

=  $S 67^{\circ}56' E$

(b) RB of  $339^{\circ}42'$

=  $360 - 339^{\circ}42'$

=  $N 20^{\circ}18' W$

**14. Convert the following WCB into RB. (a)  $151^{\circ}20'$  (b)  $332^{\circ}40'$**

(a) RB of  $151^{\circ}20'$

=  $180 - 151^{\circ}20'$

=  $S 28^{\circ}40' E$

(b) RB of  $332^{\circ}40'$

=  $360 - 332^{\circ}40'$

=  $N 27^{\circ}20' W$

**15. The bearing of a line PQ is  $N 50^{\circ}25' E$ . What is its whole circle bearing?**

□ The bearing of given line PQ is  $N 50^{\circ}25' E$ . It lies in the first quadrant and hence, its whole circle bearing is also  $50^{\circ}25'$ .

**16. Convert the following RB into WCB (a)  $S 34^{\circ}42' E$  (b)  $N 02^{\circ}18' W$**

(a) WCB of  $S 34^{\circ}42' E = 180 - 34^{\circ}42' = 145^{\circ}18'$

(b) WCB of  $N 02^{\circ}18' W = 360 - 02^{\circ}18' = 357^{\circ}42'$

**17. Differentiate between the fore bearing and back bearing of a line. The fore bearing of a line PQ is  $N 28^{\circ}W$ . What is its back bearing?**

The bearing of a survey line in the direction of the progress of survey is known as **Fore Bearing** (or) **Forward Bearing (FB)**, and the bearing taken in the opposite direction of the progress of survey is called **Reverse** (or) **Back Bearing (BB)**.

**18. Name some of the accessories used in plane tabling.**

- ☐ The following instruments are used in plane tabling.
- 1. Plane table with tripod stand
- 2. Alidade (or) Sight Rule
- 3. Spirit Level
- 4. Compass
- 5. Plumbing Fork
- 6. Drawing Paper

**19. Name some of the errors in plane table surveying.**

- ☐ Various errors in plane table surveying are classified as follows.
- 1. Instrumental Errors.
- 2. Plotting Errors.
- 3. Manipulation and Sighting errors.

**20. What is resection in plan tabling?**

**Resection** is defined as the process of locating the plane table station, by back ray method from the plotted station on the sheet. This method is also called **Interpolation method** (or) **Fixing method**.

- 1. Back ray method
- 2. Two point Problem method
- 3. Three point Problem method
- 4. A box compass method.

**21. What is Two-Point Problem?**

**Two-Point problem** is defined as the process of locating the plane-table station on the sheet, by sighting two well-defined points and its locations are already plotted on the paper.

**22. Define Three-Point Problem?**

Three point problems is defined as the process of locating the plane table station on the sheet by sighting three well defined points and its locations are already plotted on the paper.

**23. When is plane table surveying adopted?**

- ☐ Plane table surveying suitable,
- ☐ When the time required to survey the area in the field is comparatively high
- ☐ Where higher accuracy is not required.
- ☐ For small scale maps
- ☐ For magnetic areas, where a compass survey is not reliable.

**24. What is the use of trough compass in plane table surveying?**

A trough compass in plane table surveying is used for orienting the plane table to the magnetic north.

The edge of the compass box is perfectly straight and the bottom is perfectly flat. A line along the edge of the compass is drawn, which defines the magnetic north.

## UNIT III

### LEVELLING AND APPLICATIONS

### **1. Differentiate between a level line and horizontal line.**

❖ **Level line** is defined as the line lying on the level surface. At every point, the level surface and the level line are normal to the plumb line. The surface of still water (in a lake) represents the level surface and the level line.

❖ **Horizontal line** is defined as the line, lying on the horizontal surface. It is a straight line tangential to the level line.

### **2. Distinguish between line of Collimation and line of sight.**

❖ The imaginary straight line passing through the optical centre of the object and the point of intersection of the cross-hairs is called line of collimation.

❖ The imaginary straight line passing through the optical centre of the object, traversing the eye piece and entering the eye is called line of sight.

### **3. State Plane of collimation and line of collimation**

❖ The horizontal plane in which the telescope of a adjusted and corrected levelling instrument about its vertical axis is called plane of collimation.

❖ The imaginary straight line passing through the optical centre of the object and the point of intersection of the cross-hairs is called line of collimation.

### **4. What is Dumpy Level?**

This is the simplest type of the levelling instrument and it is compact and stable. It consists of a telescope, rigidly fixed to the supports. It can neither be rotated about its longitudinal axis nor can it be removed from its supports. A long bubble tube is attached to the top of the telescope.

### **5. Explain the use of Dumpy level and Tilting Levels.**

In tilting level, the line of sight and the vertical axis need not be exactly perpendicular to each other, and hence tilting levels are used for quick levelling.

### **6. What is fore sight?**

Foresight is the last sight taken on a levelling staff held over an unknown elevation, before shifting the level.

### **7. What is back sight?**

The first reading on the levelling staff, at a station of known elevation is called **back sight**. Back sight is used to obtain the height of the instrument.

### **8. Define the following terms:**

**Turning Point, Fore Sight, Back Sight and Bench Mark**



- ❖ Turning Point or Change point is defined as the instrument station, at which, the instrument is shifted from one point to another. It is the point, on which the back sight of the new station and foresight of the previous station are taken. Stable points and well-defined points are taken as the change (or) turning points.
- ❖ Foresight is the last sight taken on a levelling staff held over an unknown elevation, before shifting the level.
- ❖ The first reading on the levelling staff, at a station of known elevation is called **back sight**. Back sight is used to obtain the height of the instrument.
- ❖ Reference point of known elevation is called benchmark.

### **9. Define Bench Mark.**

Reference point of known elevation is called benchmark.

### **10. Write the types of bench mark.**

1. G.T.S. Benchmark
2. Permanent Benchmark
3. Temporary Benchmark
4. Arbitrary Benchmark

### **11. What are G.T.S. Bench marks?**

G.T.S. benchmarks are established by the GTS Department of India, with highest accuracy at an interval of about 100 km, all over the country. Their elevations are referred to as M.S.L. datum.

### **12. What are the types of Staves?**

1. Self-Reading staff
  - (a) Solid Staff
  - (b) Folding Staff
  - (c) Telescopic Staff
2. Target staff

### **13. What is meant by change point in levelling?**

Turning Point or Change point is defined as the instrument station, at which, the instrument is shifted from one point to another. It is the point, on which the back sight of the new station and foresight of the previous station are taken. Stable points and well-defined points are taken as the change (or) turning points.

### **14. What is meant by height of collimation?**

The R.L. (or) elevation of the line of collimation, when the instrument is perfectly levelled, is called the **Height of the Instrument**.

### 15. What is Reciprocal Levelling?

**It is the method of levelling and it is used** when the instrument is placed equidistant from the back staff and foreword staff stations, the difference in elevation of two stations, is equal to the difference of staff readings.

### 16. Name the sources of errors in leveling?

Errors in leveling may be categorized into

- i. Personal error
- ii. Errors due to natural factors and
- iii. Instrumental error.

### 17. Define levelling. what are the use of levelling?

It is a branch of surveying, the object of which is

- i. To find the elevation of given or assumed datum
- ii. To establish points at a given elevation or at different elevation with respect to a given or assumed datum

### 18. What are the different types of levelling staff?

Target staff

Self reading staff

Solid staff

Folding staff

Telescopic staff

### 19. Explain the theory of direct levelling?

It is the branch of levelling in which the vertical distance with respect to a horizontal line may be used to determine the relative difference in elevation between two adjacent points.

Step involved

$$HI = \text{known RL (BM)} + BS$$

$$RL = HI - FS$$

### 20. Compare height of collimation and rise and fall method

S.NO	HEIGHT OF COLLIMATION METHOD	RISE AND FALL METHOD
1.	It is more rapid and less tedious and simpler as it involving few calculation	It is more laborious and tedious involving several calculation
2.	There is no check on the RL of the intermediate points	There is check on the RL of the intermediate points

3.	Errors in intermediate RL's cannot be detected	Errors in intermediate RL's can be detected
4.	It is suitable in the case of LS & CS contour etc	It is suitable in the case of fly levelling intermediate sights are less

## UNIT-IV

### LEVELLING APPLICATIONS

#### 1. Define Cross-Sectioning and its applications.

- ❖ **Cross-Sectioning** is defined as the process of determining the lateral outline of the ground while levelling the sections right angles to the centreline.
- ❖ The length of the cross-sections from the centreline depends on the ground features and the nature of the project.
- ❖ For the **Highway Project**, the length varies from 30 m to 60 m on either sides of the centreline. For the railway project, the **length** varies from 200 m to 300 m.

#### 2. Define Contour.

- ❖ **Contour** is defined as the imaginary line, joining the points of equal elevation (RLs). It is a line of intersection of a level surface with the ground. Generally, Contour lines are marked with their elevations from the datum. The map representing the contour lines is called **Contour Map**.

#### 3. Define the term Contouring.

- ❖ **Contouring** is defined as the process of locating the contour lines on the surface of the earth.

#### 4. What do you mean by contour interval?

- ❖ Contour interval is defined as the vertical distance between any two consecutive contours. It is a constant for a map.

#### 6. Define the term Contour Gradient.

- ❖ The imaginary line, throughout the surface of the earth having a constant inclination to the horizontal is called **contour gradient**.

#### 7. What is horizontal equivalent? Why it is not a constant?

❖ **Horizontal equivalent** is defined as the horizontal distance between the two consecutive contour lines. It is not a constant for a map. If the **H.E.** is small, it indicates the steeper slope. H.E. depends on the slope of the ground.

#### **8. What are the methods of the indirect contouring method?**

❖ Following three methods are generally followed in the indirect contouring method.

1. By Squares
2. By cross-sections
3. By tacheometric method

#### **9. What are the uses of Contours?**

1. To identify the topography of the place, whether the ground is flat, undulating or mountainous.
2. To finalize the most suitable and most economical sites for engineering projects such as roads, railways, reservoirs, canals, sewers etc.
3. To determine the catchment area of the drainage basin and the capacity of the reservoir.
4. To calculate the earth work for engineering projects.
5. To ascertain the intervisibility of points.
6. To identify the contour gradient for road alignment.
7. To draw the L.S and C.S to ascertain the nature of the ground.
8. To decide the intervisible and invisible points, positions of **Gunman**, etc., in the military field.

#### **10. Define Mass diagram (or Mass-Haul Diagram)**

❖ Mass diagram (or Mass-Haul Diagram) is defined as the curve plotted based on distance, used to calculate the volume of cutting and filling of earth work for a project. The ordinate at any point represents the algebraic sum of cuttings and fillings, from the starting point of the earthwork to that point, considering the cuttings are taken as positive and filling are taken as negative.

#### **11. Define topographic map.**

The vertical plane measurements to represent the various levels of the ground surface are shown on maps showing horizontal plan measurement in a topographical map.

#### **12. What are the factors on which the choice of contour interval depends?**

- a) Purpose of map
- b) Nature of the ground
- c) Scale of map

- d) Extent of survey
- e) Time and funds available

**13. Mention the direct method of contouring?**

In this method, the contouring to be plotted are actually traced on the ground by directly locating & marking number of points on each contours.

**14. Mention the Indirect method of contouring?**

In this method, the spot levels of selected guides point representing ridges, valleys, summits, depression changes in slope are taken with a level and their levels are computed.

**15. Define interpolation contouring.**

The process of locating the contouring points between the plotted ground points is termed as interpolated ground.

**16. Mention method of interpolation of contours?**

- a) By estimation
- b) By arithmetical calculation
- c) By graphical methods

**17. What are the uses of contour map?**

- a) Most economical and suitable site for engineer work such as road, railway, and canal can be selected easily.
- b) Volume of the earth work for any work can be estimated. The capacity of the reservoir, area of the catchments can be calculated.
- c) Longitudinal and cross section can be drawn along any direction to know the nature of the ground.

**18. Define Cross Sectioning**

Cross section is run at right angle to the longitudinal profile and on either side of it for the purpose of lateral outline of the ground surface.

**19. What are the uses of mass of haul diagram?**

- a. To find an economical scheme for distributing the excavated materials
- b. To avoid the wastage of the material at one place and borrowing at another place.

**20. What is mean by planimeter?**

It is an instrument to measure an irregular area on a map called planimeter is used extensively.

## **UNIT V**

### **THEODOLITE SURVEYING**

**1. What is transit Theodolite?**

**Transit theodolite** is defined as the theodolite, in which its telescope can be rotated horizontally through 180° in the vertical plane.

**2. List out the major parts of a Theodolite.**

1. Top Assembly (Alidade Assembly)
2. Middle Assembly (Horizontal Circle Assembly)
3. Bottom Assembly (Levelling Head Assembly)

**3. List the qualities of a Theodolite telescope?**

- ❖ Internal focusing telescopes are best suited instead of external telescopes.
- ❖ The magnification factor of the internal focusing telescope should be from 15 to 30 times of the diameter.

**4. State the location and function of a plate bubble of a Theodolite.**

- ❖ Plate bubble is placed parallel to the trunnion axis at the upper plate (or vernier plate)

**5. How do you eliminate parallax in Theodolite?**

- ❖ Parallax effect can be eliminated as follows.
  - (a) Focussing the eye piece
  - (b) Focussing the objective

**6. What are the two methods of measuring the horizontal angle using a Theodolite? When each method is advantageously used?**

- ✓ Repetition Method
- ✓ Reiteration Method

The method of repetition is preferred for the measurement of a single angle.

The method of reiteration is preferred in triangulation, where a number of angles may be required at one point by the instrument.

**7. What are the errors eliminated in measurements of horizontal angle by method of repetition?**

- ❖ Instrumental and Observational errors are eliminated in measurements of horizontal angle by method of repetition.

**8. What you mean by temporary adjustments of a Theodolite?**

- ❖ The adjustments required to be made at every instrument station before taking observations are called temporary adjustments.
- ❖ The temporary adjustments of a theodolite consist of the following operations.
  1. Setting and centring the theodolite
  2. Levelling of the theodolite
  3. Elimination of parallax

**9. What are the different systems of tacheometric surveying?**

**i) Stadia system**

In the stadia system the diaphragm of the tacheometer is provided with two stadia hairs (upper & lower).

They are two kinds of stadia system.

Fixedhair method & movable hair method.

**ii) Tangential system**

In the tangential system the diaphragm of the tacheometer is not provided with stadia hairs. Only the single horizontal hair is used to take the reading

**10. What is a collimation adjustment? Adjustment of the level of the Telescope**

❖ In this adjustment, the line of collimation should remain horizontal, when the bubble of the level tube fitted on telescope is brought at the centre of its run. This adjustment is essential when a theodolite is used as a level and also when vertical angles are observed.

**11. What is face right observation?**

❖ When the vertical circle of the theodolite is on the right of the observer, then the telescope position is called **Face Right**.

**12. Explain face left and face right observations in Theodolite traversing?**

❖ When the vertical circle of the theodolite is on the left of the observer, the telescope position is called **Face Left**.

❖ When the vertical circle of the theodolite is on the right of the observer, then the telescope position is called **Face Right**.

**13. What kind of error can be eliminated by taking face left and face right observations?**

- ❖ Instrumental error can be eliminated by taking face left and face right observations
- ✓ Line of collimation not perpendicular to the trunnion axis
- ✓ Horizontal axis not perpendicular to vertical axis
- ✓ Vertical Index Errors

**14. What is meant by subtense bar?**

The subtense bar is an instrument used for measuring the horizontal distance between the instrument station and a point on the ground. The bar of varying length 3 to 4m.

**15. Define mass haul diagram?**

Mass haul diagram is a graphical representation of the cumulative amount of earth work moved along the centreline and distances over which the earth and materials are to be transported.

**16. What is meant by tacheometric surveying?**

Tacheometric surveying is the branch of surveying in which angular observations are made with an instrument called tacheometer to determine horizontal and vertical distance. Here, use of chain has been completely eliminated.

**17. Explain fixed hair method?**

In this type of method the distance between the stadia hairs is fixed and thus the method is known as fixed hair method.

**18. Explain movable hair method?**

In this type of method the distance between the stadia hairs is varied while the staff intercept is kept constant. The staff is provided with two tangents at a known distance apart and a third target at a middle.

**19. What is an anallatic lens?**

An anallatic lens is an additional convex lens mounted in external focusing telescope in between the object glass and diaphragm. This arrangement is made to reduce the additive constant to zero. This arrangement simplifies the mathematical calculations and only multiplying constant is zero.

**20. What are the three types of telescopes used in stadia surveying?**

- i. External focussing telescope
- ii. External focussing anallactic telescope
- iii. internal focussing telescope

**21. Define height and distance?**

Trigonometrical levelling is an indirect method of levelling. The relative elevation of various points are determined from the observed vertical angles and horizontal distance by the use of trigonometrical relations. The vertical angle are measured with the theodolite and horizontal are measured with the tape or chain.

**22. What are the different methods used to find the elevations of the points in the case of inaccessible points? Differentiate that?**

Single plane method

Double plane method

s.no	Single plane method	Double plane method
1	Two instrument stations are chosen in line with the object.	Two instrument stations are chosen which are not in line with the object.
2	Two vertical angles are measured in the same vertical plane	Two vertical angles are measured in the two vertical plane
3	Horizontal angles are not required	Horizontal angles are also measured

**13 MARKS**

**UNIT-I**

**FUNDAMENTALS AND CHAIN SURVEYING**

1. Explain the principles of surveying? With a simple sketch state the construction and use of a cross staff
2. a. Explain the different method of ranging with neat sketch.  
b. What are the accessories for a chain survey? Explain the functions of each.
3. How chain can be done on an uneven ground or sloping ground? Point out the advantages and disadvantages of this method.
4. Explain different corrections that can be applied to chain or tape.
5. Explain in details how a chain traversing can be done.
6. The distance between two points measured with a Gunter's chain was found to be 7500 links. The same distance was measured with an Engineers chain and was found to be 4930 feet. If the Gunter's chain was 0.25 Link too short, what was error in engineer's chain?
7. A chain was tested before starting a survey and was found to be exactly 20m and 20cm. The area of the plan drawn to a scale 8cm to 1cm was 220sq.cm. Find the true area of the field.
8. A 30m chain was found to be 0.1m too long after chaining 2400m. If the chain was correct before commencement of the work, find the true distance.



9. what are the methods of obstacles?

10. A 30m steel tape was standardized on the flat and was found to be exactly 3mm under no pull at 66°F. It was used in catenar to measure a base of 5 bays the temperature during the measurement was 92°F and the pull exerted during the measurement was 10kg. The area of the cross section of the tape was 0.08 sq.cm and the specific weights of steel is 7.86 g/cc.  $\alpha = 0.0000063$  per 1°F and  $E = 2.109 \times 10^6$  kg/sq.cm. Find the true length of the line.

11. A steel exactly 30m long at 18°C when supported throughout its length under a pull of 8 kg, A line was measured with a tape under a pull of 12 kg and found to be 1602 m. the mean temperature during the measurement was 26 C. Assuming the tape to be supported at every 30m, calculate the length of the line, given that cross sectional area of the tape is 0.04 sq.cm, the weight of 1 cc = 0.0077 kg, the co-efficient of expansion = .000012 per 1°C, and the modulus of elasticity =  $2.1 \times 10^3$  kg / sq.cm

## UNIT II

### COMPASS SURVEYING

1. Explain with neat sketches the different types of compasses.
2. Differentiate prismatic and surveyor compass.
3. How closing error can be adjusted by using graphical method?
4. Explain radiation method of plane tabling.
5. Explain intersection method of plane tabling.
6. Explain traversing method of plane tabling.
7. Explain two-point problem.
8. Explain three-point problem.
9. Write notes on
  - (i) Whole circle bearing (WCB) and quadrantal bearing (QB) system
  - (ii) Adjustments of a prismatic compass.
10. The following angles were observed in clockwise direction in an open traverse angle ABC = 124°15', angle BCD = 156°30' angle CDE = 102°0' angle DEF = 95°15' angle EFG = 215°30' magnetic bearing of line AB was 241°30'. what would be the bearing of line FG = ?.
11. Explain different method of plotting a compass traverse?
12. The following bearings were observed while traversing with a compass. Mention which station were affected by local attraction and determine the corrected bearing.

LINE	F.B	B.B
AB	75°05'	254°20'
BC	115°20'	296°35'
CD	165°35'	345°35'
DE	224°50'	44°05'
EA	304°50'	125°05'

13. The following bearings were observed while traversing with a compass. Mention which stations were affected by local attraction and determine the corrected bearings.

LINE	F.B	B.B
AB	305°00'	125°30'
BC	75°30'	254°30'
CD	115°30'	297°00'
DE	165°30'	345°30'
EA	225°00'	44°00'

14. The following bearings were recorded while conducting a closed traverse using a compass. Find out the stations affected by local attraction and determine the corrected bearings.

LINE	F.B	B.B
AB	45°45'	226°10'
BC	96°55'	277°05'
CD	29°45'	209°10'
DA	324°48'	144°48'

### UNIT-III

#### LEVELING

- 1) Explain the different types of levels and staves with neat sketches.
- 2) a) Mention the differences between height of collimation method and rise and fall method  
b) Record the following observations in the form of a leveling field book and obtain the reduced level of the each point. Give the necessary checks. Reading on inverted staff on point A whose reduced level is 52.345 = 3.565 Reading on staff on point B natural ground = 0.855 Change of instruments position. Reading on staff on point B on ground = 1.210 Reading on inverted staff on point C = 3.975 Use rise and fall method and height of collimation method.
- 3) The following consecutive readings were taken along AB with a 4m leveling staff on continuously sloping ground at intervals of 20m: 0.34m on A, 1.450, 2.630, 3.875, 0.655, 1.745, 2.965, 3.945, 1.125, 2.475, 3.865 on B. The elevation A was 60.350. Enter the above readings in a level book form and work out RLs by rise and fall method. Also find the gradient of the line AB.
- 4) Explain, in details, the different types of leveling.
- 6) What is sensitiveness? How is it measured? Explain.
- 7) The following notes refer to reciprocal levels taken with one level. Inst.at Staff Reading on  
Remarks A B P 1.820 2.740 Dist PQ = 1010m Q RL of P = 126.380 Find (a) true RL of Q (b)

Combination for curvature and refraction (c) Angular error in collimation adjustment of the inst. What will be the difference in answers are interchanged?

8) Two points A and B are 1200m apart across a wide river. The following reciprocal levels are taken with one level. Inst station Staff reading on A B A 1.485 2.365 B 1.035 1.402. The error in the collimation adjustment of the level is +0.008m in 60m. Calculate the true difference of level between A and B and the error due to refraction only.

9) In testing a dumpy level for the collimation error, the following observations were obtained. Level at Staff readings on Remarks A B C 1.465 2.005 C' Is exactly midway between A & B D 1.310 1.660 'D' Is midway between A & C and in same St. line as A, C & B. Dist between A & B = 80m Find out the staff readings on A and B in order that the line of collimation is truly HI when the instruments was at D.

10) The following reciprocal level were taken during the testing of a dumpy level. Level at Staff reading on A B A 1.370 2.105 B 1.140 1.765 is the line of collimation adjustments? Find the true readings.

## **UNIT-IV**

### **LEVELLING APPLICATIONS**

1. Explain the characteristics of contours.
2. Explain the methods of locating contours.
3. Explain the interpolation of contours with neat sketch
4. Explain the uses of contours maps.
5. Derive the formulas for calculation of areas and Volumes.
6. Drive on expression for simpson's rule and trapezoidal rule.
7. The following offsets were taken from a chain line to a hedge. Distance in m 0 6 12 18 24 36 48 60 72 81 90 Offsets in m Calculate the area using (i) Simpson's rule (ii) trapezoidal rule.
8. Certain field has three straights sides PQ, QR, RS and an irregular side PS. Calculate the area of the field from the following data. PQ = 130m, QR = 200m, PS = 150m, PR = 230m. Offset taken outwards from PS to the irregular boundary at chain ages 0, 30, 60, 90, 120 and 150 Have values 0, 3.2, 1.6, 6.8, 4.0 and 0 .

9. The following perpendicular offsets were taken at 10 meters intervals from a survey line to an irregular boundary line. 3.25, 5.60, 4.20, 6.65, 8.75, 6.20, 3.25, 4.20, 5.65. Calculate the area using average ordinate rule, trapezoidal rule and Simpson's rule.

10. A railway embankment is 10m wide with side slopes 2:1. Assuming the ground to be level in a direction traverse to the centerline, calculate the volume contained in a length of 150m, the central heights at 30m intervals being 2.5, 3.00, 4.00, 3.75, and 2.75 respectively.

## UNIT-V

### THEODOLITE SURVEYING

1. The following readings were taken on a vertical staff with a tacheometer fitted with an analytic lens and having a constant of 100. Staff station Bearing Staff readings Vertical angles A  $47^{\circ}10'$  0.940 1.500, 2.060  $8^{\circ}0'$  B  $227^{\circ}10'$  0.847 2.000 3.153  $-5^{\circ}0'$  Calculate the relative level of the ground at A and B and the gradient between A and B.

2. How do you calculate the horizontal and vertical distances between an instrument station and a staff station when the line of collimation is inclined to the horizontal and the staff is held vertically.

3. Explain the procedure of estimating the horizontal and vertical distances where the line of collimation is inclined to the horizontal and the staff is held normal to the line of collimation

4. The following notes refer to a line levelled tacheometrically with an anallatic tacheometer, the multiplying constant being 100: Inst. station Height of axis Staff station Vertical angles Hair readings Remarks P 1.5 B.M  $-6^{\circ}12'$  0.963, 1.515, 2.067 R.L of B.M. = 460.65 m staff held vertically. P 1.5 Q  $7^{\circ}5'$  0.819, 1.341, 1.863 Q 1.6 R  $12^{\circ}27'$  1.860, 2.445, 3.030 Compute the reduced levels of P, Q and R and the horizontal distances PQ and QR.

5. A tacheometer is setup at an intermediate point at on a traverse course PQ. The Following observations are made on the vertically held staff. Staff Station Vertical Angle Staff Intercept Axial Hair reading P  $8^{\circ}36'$  2.350 2.105 Q  $6^{\circ}6'$  2.055 1.895 The Instrument is fitted with an analytic lens and the constant is 100- compute the length of PQ and R-C of Q that of P being 321.5m.

6. Calculate the horizontal and vertical distances using tangential tacheometry when both the observed angles are angle of elevation and angle of depression.

7. A theodolite has a tacheometric multiplying constant of 100 and an additive constant of zero. The centre reading on a vertical staff held at point B was 2.292 m when sighted from A. If the vertical angle was  $+25^{\circ}$  and the horizontal distance AB 190.326 m, calculate the other staff readings and show that the two intercept intervals are not equal. Using these values, calculate the level of B if A is 37.950 m angle of depression and the height of the instrument is 1.35 m.

8. Explain the different between tangential and stadia tacheometry. How will you determine the stadia constants?

9. Two points A & B are on opposite sides of a summit. The tacheometer was set up at P on top of the summit, and the following readings were taken. Inst. station Height of axis Staff station Vertical angles Hair readings Remarks P 1.500 A  $-10^{\circ}$  1.150, 2.050, 2.950 RL of P = 450.500m P 1.500 B  $-12^{\circ}$  0.855, 1.605, 2.355

10. The following observation were made using a tacheometer fitted with an anallatic lens, the multiplying constant being 100. Inst. station Height of axis Staff station WCB Vertical angles Hair readings Remarks O 1.550 A  $30^{\circ}30'$   $4^{\circ}30'$  1.155, 1.755, 2.355 RL of O = 150.00 B  $75^{\circ}30'$   $10^{\circ}15'$  1.250, 2.00, 2.750. Calculate the distance AB, and the RLs of A and B. Find also the gradient of the line AB.

11. Two observations were taken upon a vertical staff by means of a theodolite, the reduced level of its trunnion axis being 160.95. In the case of the first, the angle of elevation was  $4^{\circ}36'$  and the staff reading 0.75. In the case of second observation, the staff reading was 3.45 and the angle of elevation  $5^{\circ}48'$ . Calculate the reduced level of the staff station and its distance from the instrument.

12. A staff was held vertically at distance of 45m and 120m from the centre of a theodolite fitted with stadia hairs and the staff intercepts with the telescope horizontal were 0.447m and 1.193m respectively. The instrument was then set over a station P of R.L 500.25m and the height of the instrument was 1.45m. The hair readings on a staff held vertically at station Q were 1.20, 1.93 and 2.66m while the vertical angle was  $-9^{\circ}30'$ . Find the distance PQ and the RL of Q.

13. Explain the permanent adjustment of theodolite?

14. Explain the parts of theodolite?

15. How horizontal angles are measured using repetition a reiteration method?

## **ASSIGNMENT QUESTIONS**

### **ASSIGNMENT 1**

1. Explain different corrections that can be applied to chain or tape
2. A steel exactly 30m long at  $18^{\circ}\text{C}$  when supported throughout its length under a pull of 8 kg, A line was measured with a tape under a pull of 12 kg and found to be 1602 m. the mean temperature during the measurement was  $26^{\circ}\text{C}$ . Assuming the tape to be supported at every 30m, calculate the length of the line, given that cross sectional area of the tape is 0.04 sq.cm, the weight of 1 cc = 0.0077 kg, the co-efficient of expansion = .000012 per  $1^{\circ}\text{C}$ , and the modulus of elasticity =  $2.1 \times 10^3$  kg / sq.cm
3. What are the instruments for chaining?
4. Differentiate prismatic and surveyor compass
5. Explain two-point & Three Point problem.
6. Explain intersection & radiation method of plane tabling?
7. Explain about characteristics of contours.
8. Explain about Precise levelling and its difficulties in levelling.
9. List the uses of contours.
10. Explain the temporary and permanent adjustments of a dumpy level.
11. Explain the different between tangential and stadia tacheometry. How will you determine the stadia constants?
12. Define back sight.
13. Distinguish between line of Collimation and line of sight.
14. Define the following terms: Turning Point, Fore Sight, Back Sight and Bench Mark
15. What is check leveling?

### **ASSIGNMENT 2**

## **Part A**

1. Define datum surface.
2. What are the temporary adjustments of a dumpy level?
3. What is check leveling?
4. Define back sight.
5. Distinguish between line of Collimation and line of sight.
6. Define the following terms: Turning Point, Fore Sight, Back Sight and Bench Mark
7. Differentiate between level surface and horizontal surface.
8. Define contour.
9. Define contour interval and horizontal equivalent.
10. What is meant by mass haul diagram?
11. What is called Bench mark?
12. Write the types of bench mark.
13. Name the sources of errors in leveling?
14. Define sensitivity of a bubble tube.
15. Define Cross-Sectioning and its applications.
16. What is horizontal equivalent? Why it is not a constant?
17. What are the uses of Contours?
18. What is meant by transit?
19. What are the temporary adjustments of a theodolite?
20. what is an anallatic lens?

## **21. PART-B**

1. Explain about characteristics of contours.
2. Explain about Precise levelling and its difficulties in levelling.
3. List the uses of contours.
4. Explain the temporary and permanent adjustments of a dumpy level
5. The following consecutive readings were taken along AB with a 4m leveling staff on continuously sloping ground at intervals of 20m: 0.34m on A, 1.450, 2.630, 3.875, 0.655, 1.745, 2.965, 3.945, 1.125, 2.475, 3.865 on B. The elevation A was 60.350. Enter the above readings in a level book form and work out RLs by rise and fall method. Also find the gradient of the line AB?
6. The following perpendicular offsets were taken at 10 meters intervals from a survey line to an irregular boundary line. 3.25, 5.60, 4.20, 6.65, 8.75, 6.20, 3.25, 4.20, 5.65. calculate the area using average ordinate rule, trapezoidal rule and Simpson's rule?

### ASSIGNMENT 3

#### Part A

1. What are the different methods used to find the elevations of the points in the case of inaccessible points? Differentiate that?
2. What are the three types of telescopes used in stadia surveying
3. Explain movable hair method?
4. What is mean by tacheometric surveying?
5. What kind of error can be eliminated by taking face left and face right observations?
6. Explain face left and face right observations in Theodolite traversing?
7. What you mean by temporary adjustments of a Theodolite?
8. What is transit Theodolite?
9. List out the major parts of a Theodolite.
10. What are the two methods of measuring the horizontal angle using a Theodolite?  
When each method is advantageously used?

#### PART B

11. Explain the different between tangential and stadia tacheometry. How will you determine the stadia constants?
12. A tacheometer is setup at an intermediate point at on a traverse course PQ. The

Following observations are made on the vertically held staff.

Staff Station	Vertical Angle	Staff Intercept	AxialHair reading
P	8°36'	2.350	2.105
Q	6°6'	2.055	1.895

The Instrument is fitted with an analytic lens and the constant is 100- computethe length of PQ and R-C of Q that of P being 321.5m.

13. Explain the permanent adjustment of theodolite?

# CE6302 – MECHANICS OF SOLIDS

## UNIT I STRESS AND STRAIN

### 1. Define: Stress

When an external force acts on a body, it undergoes deformation. At the same time the body resists deformation. The magnitude of the resisting force is numerically equal to the applied force. This internal resisting force per unit area is called stress.

$$\text{Stress} = \text{Force/Area}$$

$$\sigma = P/A \quad (\text{unit is N/mm}^2)$$

### 2. Define: Strain

When a body is subjected to an external force, there is some change of dimension in the body. Numerically the strain is equal to the ratio of change in length to the original length of the body.

$$\text{Strain} = \text{Change in length/Original length}$$

$$e = \delta L/L$$

### 3. Define: Elastic limit

Some external force is acting on the body, the body tends to deformation. If the force is released from the body its regain to the original position. This is called elastic limit

### 4. State: Hooke's law.

It states that when a material is loaded within its elastic limit, the stress is directly proportional to the strain.

$$\text{Stress} \propto \text{Strain}$$

$$\sigma \propto e$$

$$\sigma = Ee$$

Where, E - Young's modulus in N/mm<sup>2</sup>

$\sigma$  - Stress

e - Strain

### 5. Define: Young's modulus

The ratio of stress and strain is constant within the elastic limit. This constant is known as Young's modulus.

$$E = \text{Stress / Strain}$$

### 6. Define: Longitudinal strain

When a body is subjected to axial load P, there is an axial deformation in the length of the body. The ratio of axial deformation to the original length of the body is called lateral strain.

$$\begin{aligned} \text{Longitudinal strain} &= \text{Change in length/Original length} \\ &= \delta L/L \end{aligned}$$

### 7. Define: Lateral strain

The strain at right angles to the direction of the applied load is called lateral strain.

Lateral strain = Change in breadth (depth)/Original breadth (depth)

$$= \delta b/b \quad \text{or} \quad \delta d/d$$



**8. Define: shear stress and shear strain.**

The two equal and opposite force act tangentially on any cross sectional plane of the body tending to slide one part of the body over the other part. The stress induced is called shear stress and the corresponding strain is known as shear strain.

**9. Define: volumetric strain**

The ratio of change in volume to the original volume of the body is called volumetric strain.

Volumetric strain= change in volume / original volume

$$e_v = \delta V/V$$

**10. Define: Poisson's ratio**

When a body is stressed, within its elastic limit, the ratio of lateral strain to the longitudinal strain is constant for a given material.

Poisson's ratio ( $\mu$  or  $1/m$ ) = Lateral strain / Longitudinal strain

**11. Define: Bulk-modulus**

The ratio of direct stress to volumetric strain is called as bulk modulus..

Bulk modulus,  $K$  = Direct stress / Volumetric strain

**12. Define: Shear modulus or Modulus of rigidity**

The ratio of shear stress to shear strain is called as bulk modulus..

Shear modulus,  $G$  = shear stress / shear strain

**13. State the relationship between Young's Modulus and Modulus of Rigidity.**

$$E = 2G (1+\mu)$$

Where,

$E$  - Young's Modulus

$G$  – Modulus of rigidity

$\mu$  - Poisson's ratio

**14. Give the relationship between Bulk Modulus and Young's Modulus.**

$$E = 3K (1-2\mu)$$

Where,  $E$  - Young's Modulus  $K$  - Bulk Modulus  $\mu$ - Poisson's ratio

**15. What is principle of super position?**

The resultant deformation of the body is equal to the algebraic sum of the deformation of the individual section. Such principle is called as principle of super position

**16. What is compound bar?**

A composite bar composed of two or more different materials joined together such that the system is elongated or compressed in a single unit.

**17. What you mean by thermal stresses?**

If the body is allowed to expand or contract freely, with the rise or fall of temperature no stress is developed, but if free expansion is prevented the stress developed is called temperature stress or strain.

**18. Define thin cylinder?**

If the thickness of the wall of the cylinder vessel is less than 1/15 to 1/20 of its internal diameter, the cylinder vessel is known as thin cylinder.

**19. What are types of stress in a thin cylindrical vessel subjected to internal pressure?**

These stresses are tensile and are known as

Ø Circumferential stress (or hoop stress )

Ø Longitudinal stress

**20. What is mean by circumferential stress (or hoop stress) and longitudinal stress?**

The stress acting along the circumference of the cylinder is called circumferential stress (or hoop stress) whereas the stress acting along the length of the cylinder is known as longitudinal stress.

**21. What are the formula for finding circumferential stress and longitudinal stress?**

Circumferential stress,  $f_1 = pd / 2t$

longitudinal stress,  $f_2 = pd / 4t$

**22. What are maximum shear stresses at any point in a cylinder?**

Maximum shear stresses at any point in a cylinder, subjected to internal fluid pressure is given by  $(f_1 - f_2) / 2 = pd / 8t$

**23. What are the formula for finding circumferential strain and longitudinal strain?**

The circumferential strain ( $e_1$ ) and longitudinal strain ( $e_2$ ) are given by

$$e_1 = \frac{pd}{2tE \left[1 - \frac{\mu}{2}\right]}$$

$$e_2 = \frac{pd}{2tE} \left[\frac{1}{2} - \mu\right]$$

**24. Derive an expression for the longitudinal stress in a thin cylinder subjected to a uniform internal fluid pressure.**

$$\text{Force due to fluid pressure} = p \times \frac{\pi}{4} d^2$$

$$\text{Force due to longitudinal stress} = f_2 \times \pi d \times t$$

$$p \times \frac{\pi}{4} d^2 = f_2 \times \pi d \times t$$

$$f_2 = \frac{pd}{4t}$$

**25. What are the formula for finding change in diameter, change in length and change volume of a cylindrical shell subjected to internal fluid pressure p?**

$$\delta d = \frac{pd^2}{2tE} \left[ 1 - \frac{\mu}{2} \right]$$

$$\delta l = \frac{pdl}{2tE} \left[ \frac{1}{2} - \mu \right]$$

**26. Define Strain energy.**

When an elastic material is deformed due to application of external force, internal resistance is developed in the material of the body. Due to deformation, some work is done by the internal resistance developed in the body, which is stored in the form of energy. This is known as strain energy. It is expressed in N-m.

**27. Define Resilience.**

The total strain energy stored in the body is generally known as resilience.

**28. Define Proof Resilience.**

The maximum strain energy that can be stored in a material within the elastic limit is known as proof resilience.

**29. Define Modulus of resilience.**

It is the proof resilience of the material per unit volume.

$$\text{Modulus of resilience} = (\text{proof resilience} / \text{volume of the body})$$

## UNIT –II

### SHEAR AND BENDING IN BEAMS

#### 1. Define: Beam

BEAM is a structural member which is supported along the length and subjected to external loads acting transversely (i.e) perpendicular to the center line of the beam.

#### 2. What is mean by transverse loading on beam?

If a load is acting on the beam which perpendicular to the central line of it then it is called transverse loading.

#### 3. What is Cantilever beam?

A beam whose one end free and the other end is fixed is called cantilever beam.

#### 4. What is simply supported beam?

A beam supported or resting free on the support at its both ends is called simply supported beam.

#### 5. What is mean by over hanging beam?

If one or both of the end portions are extended beyond the support then it is called over hanging beam.

#### 6. What is mean by concentrated loads?

A load which is acting at a point is called point load.

#### 7. What is uniformly distributed load (udl) ?

If a load which is spread over a beam in such a manner that rate of loading 'w' is uniform throughout the length then it is called as udl.

#### 8. Define point of contra flexure? In which beam it occurs?

It is the Point Where the B.M is zero after Changing its sign from positive to negative or vice versa. It occurs in overhanging beam.

#### 9. What is mean by positive or sagging BM?

The BM is said to be positive if moment of the forces on the left side of beam is clockwise and on the right side of the beam is anti-clockwise.

(or)

The BM is said to be positive if the BM at that section is such that it tends to bend the beam to a curvature having concavity at the top.

#### 10. What is mean by negative or hogging BM?

The BM is said to be negative if moment of the forces on the left side of beam is anti-clockwise and on the right side of the beam is clockwise. (or)

The BM is said to be positive if the BM at that section is such that it tends to bend the beam to a curvature having convexity at the top.

**11. Define shear force and bending moment?**

SF at any cross section is defined as algebraic sum of the vertical forces acting either side of beam.

BM at any cross section is defined as algebraic sum of the moments of all the forces which are placed either side from that point.

**12. When will bending moment is maximum?**

BM will be maximum when shear force change its sign.

**13. What is maximum bending moment in a simply supported beam of span 'L' subjected to UDL of 'w' over entire span?**

$$\text{Max BM} = wL^2/8$$

**14. In a simply supported beam how will you locate point of maximum bending moment?**

The bending moment is max. when SF is zero. Writing SF equation at that point and equating to zero we can find out the distances 'x' from one end .then find maximum bending moment at that point by taking moment on right or left hand side of beam.

**15. What is shear force and bending moment diagram?**

It shows the variation of the shear force and bending moment along the length of the beam.

**16. What are the types of beams?**

1. Cantilever beam
2. Simply supported beam
3. Fixed beam
4. Continuous beam
5. over hanging beam

**17. What are the types of loads?**

1. Concentrated load or point load
2. Uniform distributed load (udl)
3. Uniform varying load(uvl)

**18. Write the assumptions in the theory of simple bending?**

1. The material of the beam is homogeneous and isotropic.
2. The beam material is stressed within the elastic limit and thus obey hooke's law.
3. The transverse section which was plane before bending remains plains after bending also.
4. Each layer of the beam is free to expand or contract independently about the layer, above or below.
5. The value of E is the same in both compression and tension.

**19. Define: Neutral Axis**

The N.A of any transverse section is defined as the line of intersection of the neutral layer with the transverse section.

**20. Write the theory of simple bending equation?**

$$(M / I) = (E / R) = (f / y)$$

Where,

M - Maximum bending moment

I - Moment of inertia

f - Maximum stress induced

y- Distance from the neutral axis

E - Young's modulus

R – Radius of neutral layer.

**21. Define: Moment of resistance**

Due to pure bending, the layers above the N.A are subjected to compressive stresses, whereas the layers below the N.A are subjected to tensile stresses. Due to these stresses, the forces will be acting on the layers. These forces will have moment about the N.A. The total moment of these forces about the N.A for a section is known as moment of resistance of the section.

**22. Define: Section modulus**

Section modulus is defined as the ratio of moment of inertia of a section about the N.A to the distance of the outermost layer from the N.A.

$$\text{Section modulus, } Z = \frac{I}{y_{\max}}$$

Where, I – M.O.I about N.A

$y_{\max}$  - Distance of the outermost layer from the N.A

## UNIT – III

### DEFLECTION

#### 1. What are the methods for finding out the slope and deflection at a section?

The important methods used for finding out the slope and deflection at a section in a loaded beam are

1. Double integration method
2. Moment area method
3. Macaulay's method
4. Conjugate beam method

The first two methods are suitable for a single load, where as the last one is suitable for several loads.

#### 2. Why moment area method is more useful, when compared with double integration?

Moment area method is more useful, as compared with double integration method because many problems which do not have a simple mathematical solution can be simplified by the moment area method.

#### 3. Explain the Theorem for conjugate beam method?

Theorem I : “The slope at any section of a loaded beam, relative to the original axis of the beam is equal to the shear in the conjugate beam at the corresponding section”

Theorem II: “The deflection at any given section of a loaded beam, relative to the original position is equal to the Bending moment at the corresponding section of the conjugate beam”

#### 4. Define method of Singularity functions?

In Macaulay's method a single equation is formed for all loading on a beam, the equation is constructed in such a way that the constant of Integration apply to all portions of the beam. This method is also called method of singularity functions.

1

#### 5. What are the points to be worth for conjugate beam method?

1. This method can be directly used for simply supported Beam
2. In this method for cantilevers and fixed beams, artificial constraints need to be supplied to the conjugate beam so that it is supported in a manner consistent with the constraints of the real beam.

#### 6. What is Maximum deflection of SSB of span 'l' with UDL of magnitude W/ unit run throughout the span?

$$\Delta = (5Wl^4) / (384EI)$$

## UNIT IV

### TORSION

**1. Write down the expression for power transmitted by a shaft**

$$P=2\pi NT/60$$

Where, N-speed in rpm

T-torque

**2. Write down the expression for torque transmitted by hollow shaft**

$$T= (\pi/16)*F_s*((D^4-d^4)/d^4$$

Where, T-torque

q- Shear stress

D-outer diameter

d- Inner diameter

**3. Write down the equation for maximum shear stress of a solid circular section in diameter 'D' when subjected to torque 'T' in a solid shaft.**

$$T=\pi/16 * F_s*D^3$$

where, T-torque

q - Shear stress

D – diameter

**4. Define torsional rigidity**

The torque required to introduce unit angle of twist in unit length is called torsional rigidity or stiffness of shaft.

**5. What is composite shaft?**

Sometimes a shaft is made up of composite section i.e. one type of shaft is sleeved over other types of shaft. At the time of sleeving, the two shafts are joined together, that the composite shaft behaves like a single shaft.

**6. What is a spring?**

A spring is an elastic member, which deflects, or distorts under the action of load and regains its original shape after the load is removed.

**7. State any two functions of springs.**

1. To measure forces in spring balance, meters and engine indicators.
2. To store energy.

**8. What are the various types of springs?**

- |                    |                                       |
|--------------------|---------------------------------------|
| i. Helical springs | ii. Spiral springs                    |
| iii. Leaf springs  | iv. Disc spring or Belleville springs |

**9. Classify the helical springs.**

1. Close – coiled or tension helical spring.
2. Open –coiled or compression helical spring.



**10. What is spring index (C)?**

The ratio of mean or pitch diameter to the diameter of wire for the spring is called the spring index.

**11. What is solid length?**

The length of a spring under the maximum compression is called its solid length. It is the product of total number of coils and the diameter of wire.

$$L_s = n_t \cdot d$$

Where,  $n_t$  = total number of coils.

**12. Define spring rate (stiffness).**

The spring stiffness or spring constant is defined as the load required per unit deflection of the spring.

$$K = W/y$$

Where, W -load

y- Deflection

**13. Define pitch.**

Pitch of the spring is defined as the axial distance between the adjacent coils in uncompressed state. Mathematically

$$\text{Pitch} = \text{free length} / (n-1)$$

**14. Define helical springs.**

The helical springs are made up of a wire coiled in the form of a helix and are primarily intended for compressive or tensile load.

**15. What are the differences between closed coil & open coil helical springs?****Closed coil spring**

The spring wires are coiled very closely, each turn is nearly at right angles to the axis of helix . Helix angle is less ( $7^\circ$  to  $10^\circ$ )

**Open coil spring**

The wires are coiled such that there is a gap between the two consecutive turns. Helix angle is large ( $>10^\circ$ )

**16. Write the assumptions in the theory of pure torsion.**

1. The material is homogenous and isotropic.
2. The stresses are within elastic limit
3. C/S which are plane before applying twisting moment remain plane even after the application of twisting moment.
4. Radial lines remain radial even after applying torsional moment.
5. The twist along the shaft is uniform

**17. Define Torsion**

When a pair of forces of equal magnitude but opposite directions acting on body, it tends to twist the body. It is known as twisting moment or torsional moment or simply as torque.

Torque is equal to the product of the force applied and the distance between the point of application of the force and the axis of the shaft.

**18. What are the assumptions made in Torsion equation**

- a) The material of the shaft is homogeneous, perfectly elastic and obeys Hooke's law.
- b) Twist is uniform along the length of the shaft
- c) The stress does not exceed the limit of proportionality
- d) The shaft circular in section remains circular after loading
- e) Strain and deformations are small.

**19. Define polar modulus**

It is the ratio between polar moment of inertia and radius of the shaft.

$$Z_p = \frac{J}{R}$$

Where, J = polar moment of inertia

R = Radius

**22. Why hollow circular shafts are preferred when compared to solid circular shafts?**

- The torque transmitted by the hollow shaft is greater than the solid shaft.
- For same material, length and given torque, the weight of the hollow shaft will be less compared to solid shaft.

**23. Write torsional equation**

$$T/J = C\theta/L = q/R$$

T-Torque

J- Polar moment of inertia

C-Modulus of rigidity

L- Length

q- Shear stress

R- Radius

**24. What are the stresses induced in the helical compression spring due to axial load?**

1. Direct shear stress
2. Torsional shear stress
3. Effect of curvature

**25. What is buckling of springs?**

The helical compression spring behaves like a column and buckles at a comparative small load when the length of the spring is more than 4 times the mean coil diameter.

**26. What is surge in springs?**

The material is subjected to higher stresses, which may cause early fatigue failure. This effect is called as spring surge.

## UNIT V

### COMPLEX STRESSES AND PLANE TRUSSES

#### 1. Define principle stresses and principle plane.

**Principle stress:** The magnitude of normal stress, acting on a principal plane is known as principal stresses.

**Principle plane:** The planes which have no shear stress are known as principal planes.

#### 2. What is the radius of Mohr's circle?

Radius of Mohr's circle is equal to the maximum shear stress.

#### 3. What is the use of Mohr's circle?

To find out the normal, resultant and principle stresses and their planes.

#### 4. List the methods to find the stresses in oblique plane?

1. Analytical method
2. Graphical method

#### 5. How method of joints applied to Trusses carrying Horizontal loads.

If a truss carries horizontal loads (with or without vertical loads) hinged at one end and supported on roller at the other end, the support reaction at the roller support end will be normal, whereas the support reaction at the hinged end will consist of i) horizontal reaction and (ii) vertical reaction

#### 6. How method of joints applied to Trusses carrying inclined loads.

If a truss carries inclined loads hinged at one end and supported on roller at the other end, the support reaction at the roller support end will be normal. Whereas the support reaction at the hinged end will consist of (i) horizontal reaction and (ii) vertical reaction. The inclined loads are resolved into horizontal and vertical components.

#### 7. What is mean by compressive and tensile force?

The forces in the member will be compressive if the member pushes the joint to which it is connected whereas the force in the member will be tensile if the member pulls the joint to which it is connected.

#### 8. How will you determine the forces in a member by method of joints?

In method of joint after determining the reactions at the supports, the equilibrium of every support is considered. This means the sum all vertical forces as well as the horizontal forces acting on a joint is equated to zero. The joint should be selected in such a way that at any time there are only two members, in which the forces are unknown.

**9. What are the benefits of method of sections compared with other methods?**

1. This method is very quick
2. When the forces in few members of the truss are to be determined, then the method of section is mostly used.

**10. A bar of cross sectional area  $600 \text{ mm}^2$  is subjected to a tensile load of 50 KN applied at each end. Determine the normal stress on a plane inclined at  $30^\circ$  to the direction of loading.**

A =  $600 \text{ mm}^2$

Load, P = 50KN

$\theta = 30^\circ$

Stress,  $\sigma = \text{Load/Area}$

$$= 50 \times 10^3 / 600$$

$$= 83.33 \text{ N/mm}^2$$

Normal stress,  $\sigma_n = \sigma \cos 2\theta$

$$= 83.33 \times \cos 60^\circ$$

$$= 41.665 \text{ N/mm}^2$$

**11. In case of equal like principle stresses, what is the diameter of the Mohr's circle?**

Answer: Zero

## UNIT 1- STRESS AND STRAIN

### PART – B (16 Marks)

1. A tensile test was conducted on a mild steel bar. The following data was obtained from the test:

- (i) Diameter of the steel bar = 3 cm
- (ii) Gauge length of the bar = 20cm
- (iii) Load at elastic limit = 250 kN
- (iv) Extension at a load of 150 kN = 0.21 mm
- (v) Maximum load = 380 kN
- (vi) Total extension = 60 mm
- (vii) Diameter of rod at failure = 2.25 cm

Determine:

- (1) The Young's modulus
- (2) The stress at elastic limit
- (3) The percentage of elongation
- (4) The percentage decrease in area.

2. Three bars made of copper; zinc and aluminium are of equal length and have cross section 500, 700, and 1000 sq.mm respectively. They are rigidly connected at their ends. If this compound member is subjected to a longitudinal pull of 250 kN, estimate the proportional of the load carried on each rod and the induced stresses. Take the value of E for copper =  $1.3 \times 10^5$  N/mm<sup>2</sup>, for zinc =  $1 \times 10^5$  N/mm<sup>2</sup> and for aluminium =  $0.8 \times 10^5$  N/mm<sup>2</sup>.

3. A bar 0.3m long is 50mm square in section for 120mm of its length, 25mm diameter for 80mm and of 40mm diameter for its remaining length. If the tensile force of 100kN is applied to the bar calculate the maximum and minimum stresses produced in it, and the total elongation. Take  $E = 2 \times 10^5$  N/mm<sup>2</sup> and assume uniform distribution of stress over the cross section.

4. A bar of 25mm diameter is subjected to a pull of 40kN. The measured extension on gauge length of 200mm is 0.085mm and the change in diameter is 0.003mm. Calculate the value of Poisson's ratio and the three moduli.

5. A cylindrical vessel, whose ends are closed by means of rigid flange plates, is made up of steel plate 3 mm thick. The length and internal diameter of the vessel are 50 cm and 25 cm respectively. Determine the longitudinal and hoop stresses in the cylindrical shell due to an internal fluid pressure of 3 N/mm<sup>2</sup>. Also calculate the increase in length, diameter and volume of vessel. Take  $E = 2 \times 10^5$  N/mm<sup>2</sup> and  $\mu = 0.3$ .

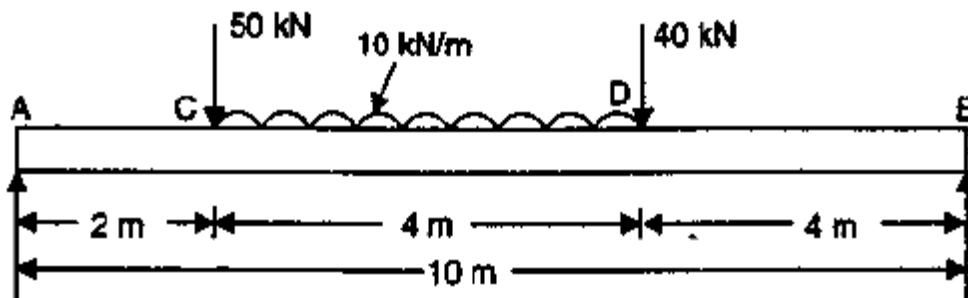
6. A hollow cylinder 2 m long has an outside diameter of 50 mm and inside diameter of 30 mm. If the cylinder is carrying a load of 25 kN, find the stress in the cylinder. Also find the deformation of the cylinder, if the value of modulus of elasticity for the cylinder material is 100 GPa.

7. A cylindrical shell of 500 mm diameter is required to withstand an internal pressure of 4 MPa. Find the minimum thickness of the shell, if maximum tensile strength for the plate material is 400 MPa and efficiency of the joints is 65%. Take factor of safety as 5.
8. A cylindrical shell 3m long which is closed at its ends has an internal diameter of 1m and a wall thickness of 15mm. calculate the circumferential and longitudinal stresses induced and also change in dimensions of the shell if it is subjected to an internal pressure of  $1.5 \text{ MN/m}^2$
9. (i) Derive a relation for change in length of a bar hanging freely under its own weight. (6)  
 (ii) Draw stress - strain curve for a mild steel rod subjected to tension and explain about the salient points on it. (10)
10. (i) Derive the relationship between bulk modulus and young's modulus. (6)  
 (ii) Derive relations for normal and shear stresses acting on an inclined plane at a point in a strained material subjected to two mutually perpendicular direct stresses. (10)
11. Two vertical rods one of steel and other of copper are rigidly fixed at the top and 80cm apart. Diameter and length of each rod are 3cm and 3.5m respectively. A cross bar fixed to the rods at lower ends carries a load of 6kN such that the cross bar remains horizontal even after loading. Find the stress in each rod and position of load on the bar. Take E for steel as  $2 \times 10^5 \text{ N/mm}^2$  and for copper as  $1 \times 10^5 \text{ N/mm}^2$

## UNIT 2- SHEAR AND BENDING IN BEAMS

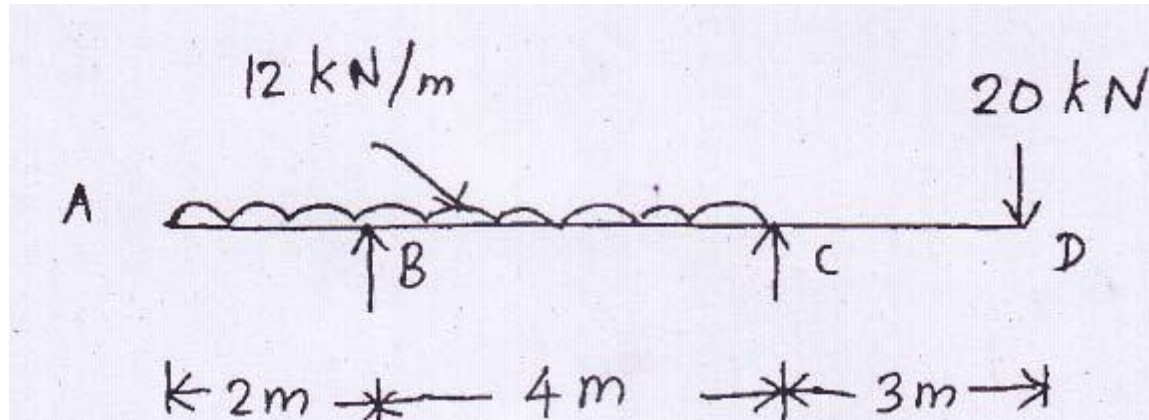
### PART – B (16 Marks)

1. A simply supported beam of length 10m carries the uniformly distributed load and two point loads as shown in Fig. Draw the S.F and B.M diagram for the beam and also calculate the maximum bending moment.



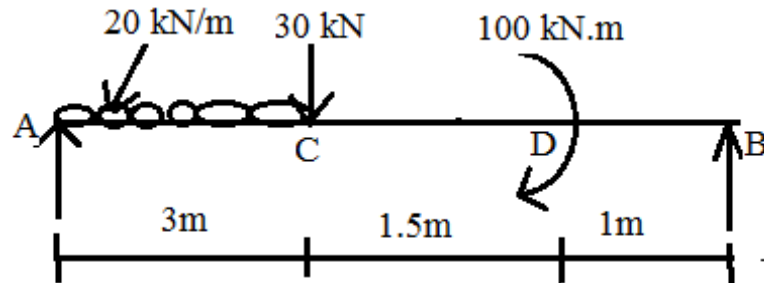
2. (i) Derive an expression for bending moment equation (8)  
 (ii) A rectangular beam 300 mm deep is simply supported over the span of 4 m. Determine the uniformly distributed load per metre which the beam may carry, if the bending stress should not exceed  $120 \text{ N/mm}^2$ . Take  $I = 8 \times 10^6 \text{ mm}^4$ . (8)

3. A cantilever beam of 2 m long carries a uniformly distributed load of 1.5 kN/m over a length of 1.6 m from the free end. Draw shear force and bending moment diagrams for the beam.
4. A simply supported beam 6 m long is carrying a uniformly distributed load of 5 kN/m over a length of 3 m from the right end. Draw shear force and bending moment diagrams for the beam and also calculate the maximum bending moment on the beam.
5. Draw shear force and bending moment diagram for the beam given in Fig.



6. State the assumptions made in the theory of simple bending and derive the bending formula.
7. A 100mm X 200mm rolled steel I section has the flanges 12mm thick and web 10mm thick. Find
  - (i) The safe udl the section can carry over a span of 6m if the permissible stress is limited to  $150 \text{ N/mm}^2$
  - (ii) The maximum bending stress when the beam carries a central point load of 20kN.
8. The cross section of T beam is as follows: Flange thickness = 10mm; width of the flange = 100mm; thickness of the web = 10mm; depth of the web = 120mm; If a shear force of 2kN is acting at a particular section of the beam draw the shear stress distribution across the section.
9. An overhanging beam ABC is simply supported at A & B over a span of 6m and BC overhangs by 3m. If the supported span AB carries a central concentrated load of 8kN and overhang span BC carries 2kN/m draw the shear force and bending moment diagram.
10. A simply supported beam of span 4m carries a udl of 6kN/m over the entire span. If the maximum allowable stress due to bending is restricted to  $150 \text{ N/mm}^2$ , determine the cross sectional dimensions if the section is;
  - (i) Rectangular with depth twice the breadth
  - (ii) Solid circular section
  - (iii) Hollow circular section having a diameter ratio of 0.6

11. Draw shear force and bending moment diagram for the beam shown in Fig.



12. A flitched beam consists of two timber joist 100mm wide and 240mm deep with a steel plate 180mm deep and 10mm thick placed symmetrically between the timber joists and well clamped. Determine

- i) The maximum fibre stress when the maximum fibre stress in wood is  $80 \text{ kg/cm}^2$ .
- ii) The combined moment of resistance if the modular ratio is 18.

### UNIT 3- DEFLECTION PART – B (16 Marks)

1. A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from the left support. Find (i) Deflection under each load

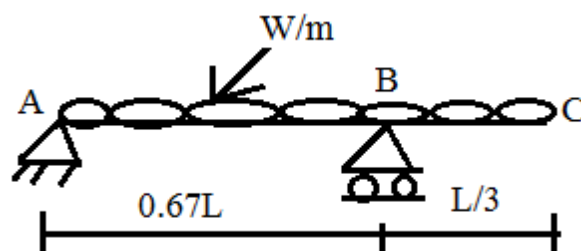
(ii) Maximum deflection

(iii) The point at which the maximum deflection occurs.

Take  $I = 85 \times 10^6 \text{ mm}^4$   $E = 2 \times 10^5 \text{ N/mm}^2$

2. A steel joist, simply supported over a span of 6 m carries a point load of 50 kN at 1.2 m from the left hand support. Find the position and magnitude of the maximum deflection. Take  $EI = 14 \times 10^{12} \text{ N/mm}^2$

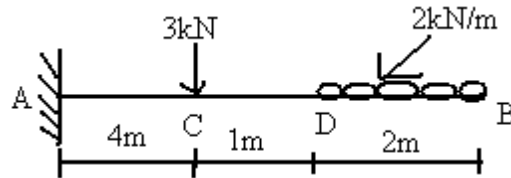
3. For the beam shown in fig show that the deflection at the free end is  $WL^4/684EI$ . Use Macaulay's method.



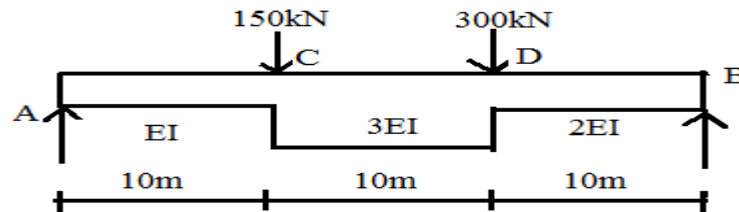
4. A cantilever of length 2.5m is loaded with an udl of 10 kN/m over a length 1.5m from the fixed end. Determine the slope and deflection at the free end. Determine the slope and deflection at the free end of the cantilever  $L = 9500 \text{ cm}^4$ ,  $E = 210 \text{ GN/m}^2$  Using Moment area method.



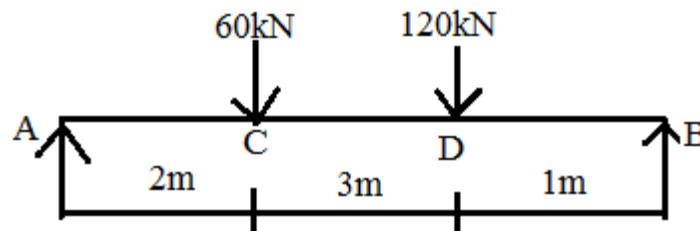
5. Find the slope and deflection at the free end of the cantilever shown in fig. Take  $EI = 1 \times 10^{10} \text{ kN/mm}^2$



6. Using conjugate beam method, obtain the slope and deflections at A, B, C and D of the beam shown in fig. Take  $E = 200 \text{ GPa}$  and  $I = 2 \times 10^{-2} \text{ m}^4$ .



7. Obtain the deflection under the greater load for the beam shown in fig using the conjugate beam method.



8. A simply supported beam of span 3 m is subjected to a central load of 10 kN. Find the maximum slope and deflection of the beam. Take  $I = 12 \times 10^6 \text{ mm}^4$  and  $E = 200 \text{ GPa}$ .

9. A beam AB of span 6m is simply supported at its ends is subjected to a point load of 20kN at C at a distance of 2m from left end. Using moment area method, Compute the deflection at the point C, slope at the points A, B and C. Take  $I = 6 \times 10^8 \text{ mm}^4$  and  $E = 200 \text{ GPa}$ .

10. A steel cantilever of 2.5m effective length carries a load of 25kN at its free end. If the deflection at the free end is not exceed 40mm. What must be the I value of the section of the cantilever. Take  $E = 210 \text{ GN/m}^2$  using moment area method.

**UNIT 4- TORSION**  
**PART – B (16 Marks)**

1. i) Derive the torsion equation for a circular shaft of diameter 'd' subjected to torque 'T'. ii) Find the torque that can be transmitted by a thin tube 6 cm mean diameter and wall thickness 1 mm. the permissible shear stress is  $6000 \text{ N/cm}^2$ .
2. A close coiled helical spring is made of a round wire having 'n' turns and the mean coil radius R is 5 times the wire diameter. Show that the stiffness of the spring =  $2.05 R/n$ . If the above spring is to support a load of 1.2kN with 120mm compression. Calculate mean radius of the coil and number of turns assuming  $G = 8200 \text{ N/mm}^2$  and permissible shear stress,  $\lambda_{\text{allowable}} = 250 \text{ N/mm}^2$ .
3. A steel shaft ABCD having a total length of 2400mm is contributed by three different sections as follows. The portion AB is hollow having outside and inside diameters 80mm and 50mm respectively, BC is solid and 80mm diameter. CD is also solid and 70mm in diameter. If the angle of twist is same for each section, determine the length of each portion and the total angle of twist. Maximum permissible shear stress is 50 MPa and shear modulus  $0.82 \times 10^5 \text{ MPa}$ .
4. It is required to design a close coiled helical spring which shall deflect 1mm under an axial load of 100N at a shear stress of 90 MPa. The spring is to be made of round wire having shear modulus of  $0.8 \times 10^5 \text{ MPa}$ . The mean diameter of the coil is to be 10 times that of the coil wire. Find the diameter and length of the wire.
5. A solid circular shaft transmits 75kW power at 200rpm. Calculate the shaft diameter, if the twist in the shaft is not to exceed one degree in 2m length of shaft and shear stress is not exceed  $50 \text{ N/mm}^2$ . Assume the modulus of rigidity of the material of the shaft as  $100 \text{ kN/mm}^2$ .
6. A shaft has to transmit 110 kW at 160rpm. If the shear stress is not to exceed  $65 \text{ N/mm}^2$  and the twist in a length of 3.5m must not exceed  $1^\circ$ , find a suitable diameter. Take  $C = 8 \times 10^4 \text{ N/mm}^2$ .
7. A leaf spring 750mm long is required to carry a central load of 8kN. If the central deflection is not to exceed 20mm and the bending stress is not to be greater than  $200 \text{ N/mm}^2$ . Determine the thickness, width and number of plates. Assume the width of the plates is 12 times, their thickness and modulus of elasticity of the springs material as  $200 \text{ kN/mm}^2$ .
8. A closely coiled helical spring made out of a 10mm diameter steel bar has 12 complete coils, each of mean diameter of 100mm. Calculate the stress induced in the section of rod, the deflection under the pull and the amount of energy stored in the spring during the extension. It is subjected to an axial pull of 200N. Modulus of rigidity is  $0.84 \times 10^5 \text{ N/mm}^2$ .
9. A close coiled helical spring has a stiffness of  $5 \text{ N/mm}$ . its length when fully compressed with adjacent coils touching each other is 40 cm. the modulus of rigidity of the material of the spring is  $8 \times 10^4 \text{ N/mm}^2$ . Determine the wire diameter and mean coil diameter if their ratio is

1/10. What is the corresponding maximum shear stress in the spring?

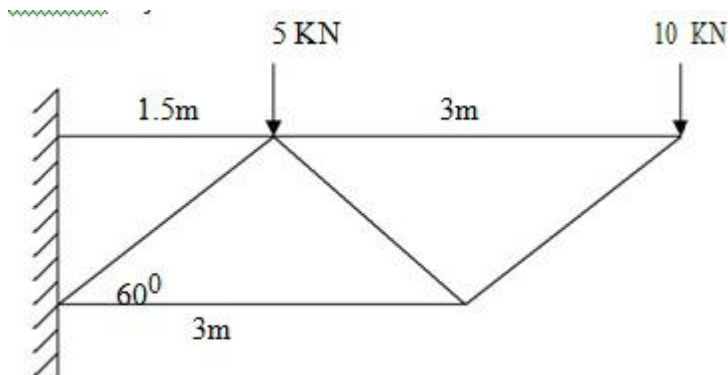
10. A circular shaft of 1000mm diameter and 2m length is subjected to a twisting moment which creates a shear stress of  $20\text{N/mm}^2$  at 30mm from the axis of the shaft. Calculate the angle of twist and the strain energy stored in the shaft. Take  $G=8 \times 10^4 \text{ N/mm}^2$ .

**UNIT V**  
**COMPLEX STRESSES AND PLANE TRUSSES**  
**Part –B(16 MARKS)**

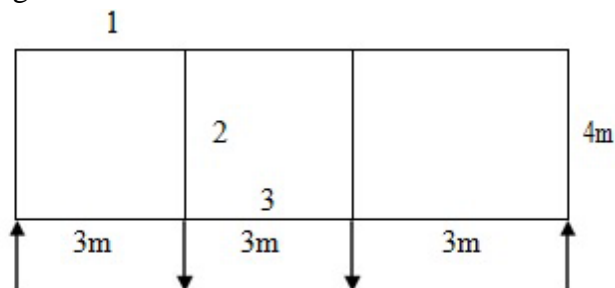
1. A rectangular block of material is subjected to a tensile stress of  $110 \text{ N/mm}^2$  on one plane and a tensile stress of  $47 \text{ N/mm}^2$  on the plane at right angle to the former. Each of the above stress is accompanied by a shear stress of  $63 \text{ N/mm}^2$ . Find (i) The direction and magnitude of each of the principal stress (ii) Magnitude of greatest shear stress.

2. At a point in a strained material, the principal stresses are  $100 \text{ N/mm}^2$  (T) and  $40 \text{ N/mm}^2$  (C). Determine the resultant stress in magnitude and direction in a plane inclined at  $60^\circ$  to the axis of major principal stress. What is the maximum intensity of shear stress in the material at the point?

3. A cantilever truss is shown in fig. Find the forces in the members of the truss by the method of joint.



4. A truss of span 9m is loaded as shown in fig. Find the reaction and forces in the members marked 1, 2, and 3 by using method of section.



5. At a point in a strained material, the principal stresses are  $100 \text{ N/mm}^2$  (T) and  $40 \text{ N/mm}^2$  (C). Determine the direction and magnitude in a plane inclined at  $60^\circ$  to the axis of major principal stress. What is the maximum intensity of shear stress in the material at the point.

6. Find the magnitude and nature of the forces in the given truss carrying loads as shown in Fig. 12(a).

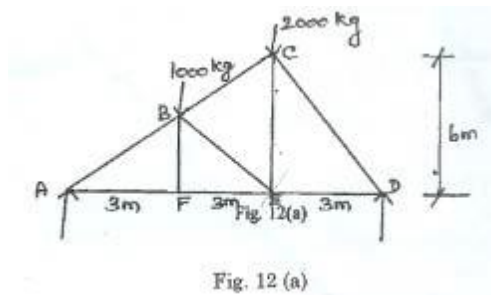
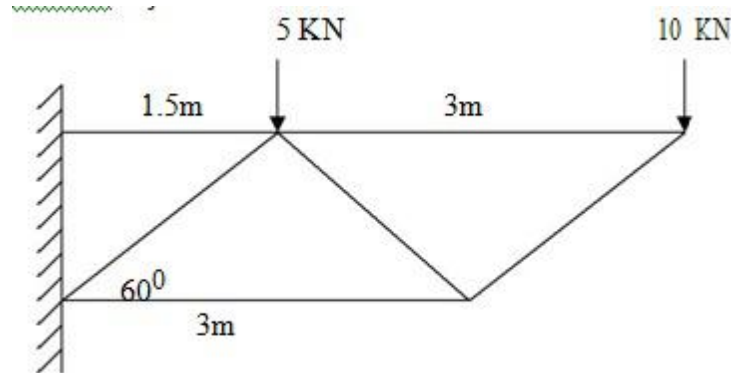


Fig. 12 (a)

7. A SS truss is shown in fig. Find the forces in the members of the truss by the method of joint Fig. 12(a).

8. A cantilever truss is shown in fig. Find the forces in the members of the truss by the method of section.



9. The principal stress in the wall of a container are  $40 \text{ MN/m}^2$  and  $80 \text{ MN/m}^2$ . Determine the normal, shear and resultant stresses in magnitude and direction in a plane, the normal of which makes an angle of  $30^\circ$  with the direction of maximum principal stress.

10. Determine the normal, shear and resultant stress in magnitude and direction in plane, the normal of which makes an angle of  $30^\circ$  with the direction of  $30 \text{ MN/m}^2$  stress (Tensile). The Value of other tensile stress is  $15 \text{ MN/m}^2$

## **ASSIGNMENT QUESTIONS**

1. How will you relate the stress – strain relationship in industry?
2. How does stress developed in thin cylinders?
3. A round bar of length L, tapers uniformly from radius  $r_1$  at one end to radius  $r_2$  at the other. Show that the extension produced by a tensile axial load P is  $(PL) / (2\pi E r_1)$ .
4. How does the stress distribution compare between a fixed –end beam and simply supported beam?
5. How do you construct a simply supported beam for a project?
6. How would you support the beam of given length to produce minimum bending?
7. Why continuous beam has less deflection than beam with support?
8. Where does maximum deflection occur in beams?
9. What is eccentric loading on a beam and how can we identify it practically?
10. How much deflection can the spring tolerate before it yields?
11. Write the role of helical spring in the railway.
12. A hollow shaft has greater strength and stiffness than a solid shaft of equal weight, Why is it true?
13. Write the application of steel trusses in the modern day Engineering?
14. Explain briefly about truss bridge construction with examples.
15. What are the practical applications of Mohr's Circle?

**CE 6303 - MECHANICS OF FLUIDS**  
**TWO MARKS QUESTION AND ANSWERS**  
**UNIT-1 - FLUID PROPERTIES AND FLUID STATICS**

**1. Define fluid?**

A fluid is a substance having a property to flow easily.

Example: liquid, vapor, gas.

## 2. Define fluid mechanics?

Fluid mechanics is a branch of science which deals with property and behavior of fluids at rest and in motion.

## 3. Define specific volume?

It is the ratio of volume to the mass of a fluid. It is denoted by  $v$ . Its unit is  $\text{m}^3/\text{kg}$ .

$v$  = volume of fluid

Mass of fluid

$$v = V/m \text{ m}^3/\text{kg}$$

## 4. Define viscosity?

It is defined as the resisting property of liquid to its flow corresponding to its adjacent layers.

## 5. Which one of the following has high viscosity (i) water or (ii) lubricating oil?

Lubricating oil has high viscosity because it reduces friction.

## 6. Define poise?

Poise is the other name of unit of viscosity in CGS system which equals  $\text{dyne-sec}/\text{cm}^2$ .

## 7. Define friction.

Friction is a force that acts in opposite direction to the movement.



## 8. What is Non Newtonian fluid?

A real fluid in which shear stress is not proportional to rate of shear strain.

$$\tau \neq \mu \frac{du}{dy}$$

$\tau$  = Shear stress  $\mu$  = viscosity of the fluid

$du$  = change in velocity  $dy$  = change in perpendicular distance.

## 9. Define compressible fluid?

A liquid is considered to a compressible fluid only when there is a change in Volume of liquid that occurs under large pressure variation.

## 10. Define compressibility?

Compressibility is the property of fluid which undergoes change in volume under various pressure conditions.

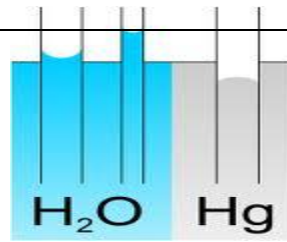
It is also defined of reciprocal of bulk modulus of elasticity ( $k$ ).

i.e., compressibility =  $1/k$ .

$k$  = compressive stress / volumetric strain

## 11. Define capillarity?

It is the phenomenon of rise or fall of liquid surface relative to outside liquid surface.



## 12. Define specific gravity with respect to weight density?

It is the ratio of specific weight of fluid to specific weight of a standard fluid.

i.e.,  $s = \frac{\text{Specific weight of liquid}}{\text{Specific weight of water}}$  (for liquids)

i.e.,  $s = \frac{\text{Specific weight of gas}}{\text{Specific weight of air}}$  (for gasses)

## 13. Define dynamic viscosity?

The shear stress required to move one layer with unit velocity over another layer at unit distance. It is known as dynamic viscosity. It is denoted as  $\mu$ .

## 14. What is cause for viscosity?

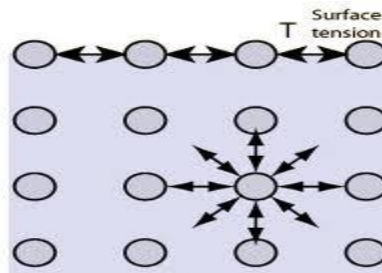
The causes for the viscosity are

- (i) Inter molecular force of cohesion and
- (ii) Moment of molecules being exchanged.

## 15. Define Surface Tension.

Surface Tension is defined as the tensile force acting on the surface of a liquid in contact with a gas or on the surface between two immiscible liquids such that the contact surface behaves like a membrane under tension.

Unit: N/m.



## 16. Give the types of gas laws?

The types of gas laws are,

- (i) Boyles law
- (ii) Charles law

## 17. Define ideal fluid?

A fluid which is incompressible and has no viscosity is called as an ideal fluid. It is an imaginary fluid.

## 18. Define Newtonian fluid.

A real fluid in which shear stress is directly proportional to the rate of shear strain.

$$\tau = \mu \cdot \frac{du}{dy}$$

## 19. Define ideal plastic fluid.

A fluid whose shear is more than yield value and its shear stress is directly proportional to shear strain is called as ideal plastic fluid.

## 20. What is an incompressible fluid?

A liquid is considered to be incompressible only when there is a change in volume of a liquid that occurs under smaller pressure variation.

### 1. Define “Pascal’s Law”.

It states that the pressure or intensity at a point in a static fluid is equal in all directions.

### 2. What is meant by Absolute pressure and gauge pressure?

#### Absolute pressure :

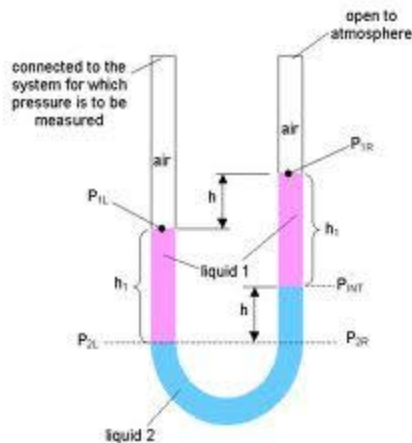
It is defined as the pressure which is measured with the reference to absolute vacuum pressure.

#### Gauge pressure:

It is defined as the pressure which is measured with the help of a pressure measuring instrument, in which the atmospheric pressure is taken as datum. The atmospheric pressure on the scale is marked as zero.

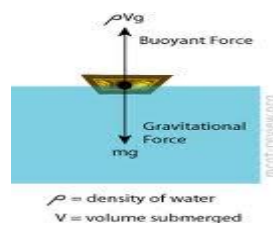
### 3. Define Manometers.

Manometers are defined as the devices used for measuring the pressure at a point in a fluid by balancing measuring the column of fluid by the same or another column of fluid.



### 4. Define Buoyancy.

When a body is immersed in a fluid, an upward force is exerted by the fluid on the body. This upward force is equal to the weight of the fluid displaced by the body and is called the force of buoyancy or simply buoyancy.



### 5. Define META-CENTRE.

It is defined as the point about which a body starts oscillating when the body is tilted by a small angle. The meta-centre may also be defined as the point at which the line of action of the force of buoyancy will meet the normal axis of the body when the body is given a small angular displacement.

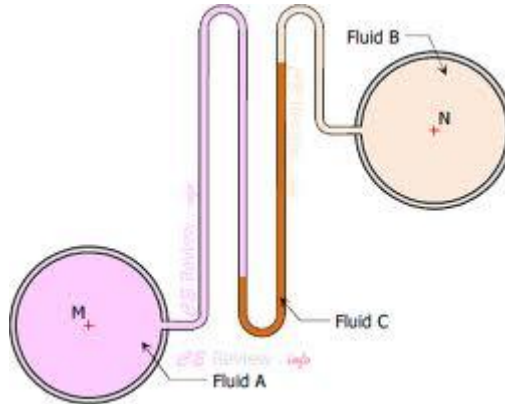


### 6. Write short notes on “Differential Manometers”.



~~Differential manometers are the devices used for measuring the difference of pressure between two points in a pipe or in two different pipes , a differential manometer consists of a U tube containing a heavy liquid , whose two ends are connected to the points , whose difference of pressure is to be measured . Most commonly types of differential manometers are:~~

1. U-tube differential manometer
2. Inverted U-tube manometer.



### 7. Define Centre of pressure.

It is defined as the point of application of the total pressure on the surface.

The submerged surface may be:

1. Vertical plane surface
2. Horizontal plane surface
3. Inclined plane surface
4. Curved surface.

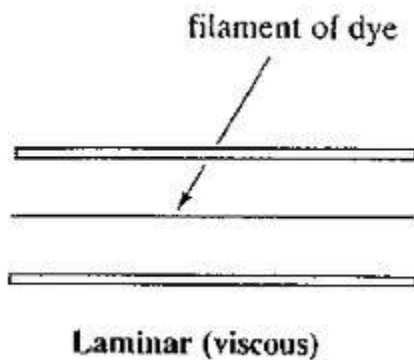
### 8. Write down the types of fluid flow.

The fluid flow is classified as :

1. Steady flow and unsteady flows
2. Uniform and non-uniform flows
3. Laminar and turbulent flows
4. Compressible and incompressible flows
5. Rotational and irrotational flows
6. One , two and three dimensional flows

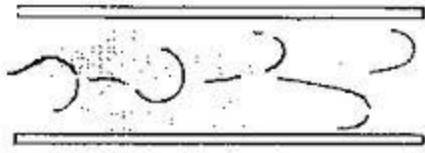
### 9. Write short notes on “laminar flow”.

Laminar flow is defined as that type of flow in which the fluid particles move along well defined paths or stream line and all the stream lines are straight and parallel. Thus the particles move in laminae or layers gliding over the adjacent layer. This type of flow is also called stream line flow or viscous flow.



### 10. Define “turbulent flow”.

Turbulent flow is that type of flow in which the fluid particles move in a zig-zag way. Due to the movement of fluid particles in a zig-zag way.



**Turbulent**

### 11. What is mean by Rate flow or Discharge?

It is defined as the quantity of a fluid flowing per second through a section of a pipe or channel. For an incompressible fluid (or liquid) the rate of flow or discharge is expressed as volume of fluid flowing across the section per second. For compressible fluids, the rate of flow is usually expressed as the weight of fluid flowing across the section.

Where ,  $A$  = Cross – sectional area of pipe

$V$ = Average velocity of fluid across the section.

### 12. What do you understand by continuity equation?

The equation based on the principle of conservation of mass is called continuity equation. Thus for a fluid flowing through the pipe at all the cross – section, the quantity of fluid per second is constant.

### 13. Differentiate steady and unsteady flow?

Steady flow	Unsteady flow
1. Steady flow is defined as that type of flow in which the fluid characteristics like velocity, pressure etc at a point do not change with time. 2. $(dv/dt)(0,0,0)=0$	1. Unsteady flow is that type of flow in which the velocity, pressure at a point like velocity, pressure etc at a point do changes with time. 2. $(dv/dt)(0,0,0) \neq 0$

### 13. Differentiate uniform and non-uniform flow?

Uniform flow	Non-uniform flow.
1. It is defined as that type of flow in which the velocity at any given time does not change with respect to space. 2. $(dv/dt)t=\text{constant}=0$	1. It is defined as that type of flow in which, the velocity at any given time changes with respect to time. 2. $(dv/dt)t=\text{constant} \neq 0$

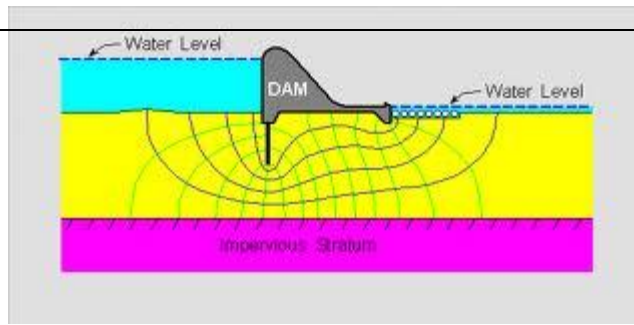
### 14. Define angular deformation.

It is defined as the average change in the angle contained by two adjacent sides. Let  $s$  &  $s$  is the change in angle between two adjacent sides of a fluid element.

The angular deformation  $= 1/2 * (S\theta_1 + S\theta_2)$ .

### 15. What is mean by Flow net?

A grid obtained by drawing a series of equipments lines and stream lines is called a flow net. The flow net is an important tool in analyzing the two –dimensional irrotational flow problems.



### 16. What is linear translation?

It is defined as the movement of a fluid element in such a way that it moves bodily from one position to represents in new position by a'b' & c'd' are parallel.

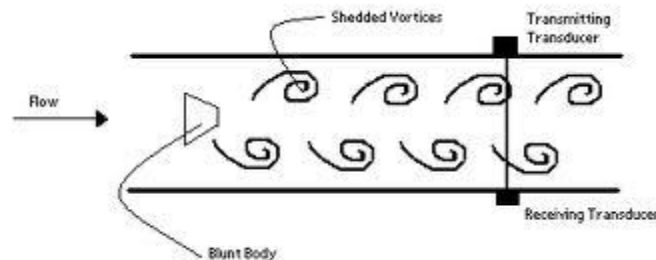
### 17. What are the types of Motion?

1. Linear Translation or pure Translation.
2. Linear deformation.
3. Angular deformation.
4. Rotation.

### 18. Define "Vortex flow".

Vortex flow is defined as the flow of a fluid along a curved path or the flow of a rotating mass of fluid is "Vortex Flow". The vortex flow is of two types namely:

1. Forced vortex flow and
2. Free vortex flow.



### 19. What is linear deformation?

It is defined as the deformation of a fluid element in linear direction when the element moves the axes of the element in the deformation position and undeformation position are parallel but their lengths changes.

## UNIT-3

### FLOW THROUGH PIPES

#### 1. What are the assumptions made in the derivation of Bernoulli's equation?

- (i) The fluid is ideal, ie., Viscosity is zero .
- (ii) The flow is steady.
- (iii) The flow is incompressible.
- (iv) The flow is irrotational.

#### 2. State the Bernoulli's theorem for steady flow of an incompressible fluid.

It states that in a steady, ideal flow of an incompressible fluid, the total energy at any point of the fluid is constant. The total energy consists of pressure energy, kinetic energy and potential energy or datum energy. These energies per unit weight of the fluid are:

$$\text{Pressure energy} = p/\rho g$$

$$\text{Kinetic energy} = v^2/2g$$

$$\text{Datum energy} = z$$

The mathematically, Bernoulli's theorem is written as

$$(p/w) + (v^2/2g) + z = \text{Constant.}$$

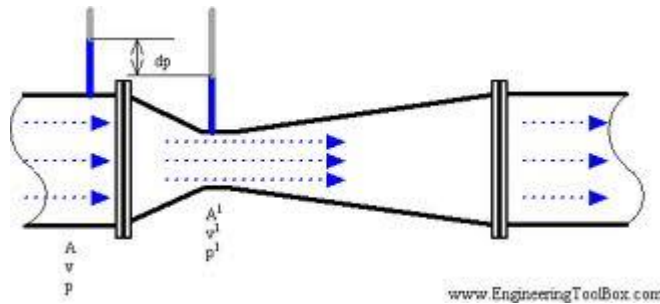
#### 3. Define Venturimeter.

Venturimeter is a device used for measuring the rate of flow of a fluid flowing through a pipe. It consists of

three (i) A short converging part

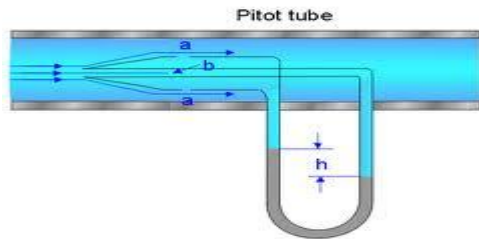
(ii) Throat

(iii) Diverging part.



#### 4. Define pitot tube.

Pitot tube is a device used for measuring the velocity of flow at any point in a pipe or channel. It is based on the principle that if the velocity of flow at a point becomes zero.



#### 5. What is meant by free liquid jet?

Free of liquid jet is defined as the jet of water coming out from the nozzle in atmosphere. The path travelled by the free jet is parabolic.

#### 6. What is meant by dynamic of fluid flow?

The study of fluid motion with the forces causing flow is called dynamics of fluid flow. The dynamic behavior of the fluid flow is analyzed by the Newton's second law of motion, which relates the acceleration with the forces.

#### 7. Write down the formulae for finding the discharge in venturimeter.

$$Q = C_d \frac{a_1 a_2}{\sqrt{a_1^2 - a_2^2}} \times \sqrt{2gh}$$

Where  $a_1$  = area of the inlet venturimeter

$a_2$  = area at the throat

$C_d$  = co efficient of venturimeter

$h$  = difference of pressure head in terms of fluid head flowing through venturimeter.

#### 8. Write the equations of motion.

The net force  $F_x$  acting on a fluid element in the direction of  $x$  is equal to mass  $m$  of the fluid element multiplied by the acceleration  $a_x$  in the  $x$ -direction.

$$F_x = ma_x$$

#### 9. What are the forces present in the fluid flow?

(i) Gravity force,  $F_g$

(ii) The pressure force,  $F_p$

(iii) Force due to viscosity,  $F_v$

(iv) Force due to turbulence,  $F_t$

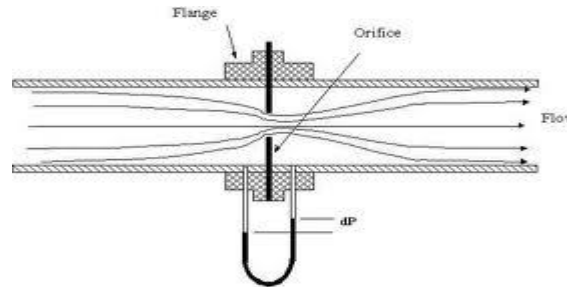
(v) Force due to compressibility,  $F_c$ .

#### 10. What are the devices used for measuring rate of flow?

- (i) Venturimeter
- (ii) Pitot tube
- (iii) Orifice meter.

**11. Define orifice meter.**

It is the device used for measuring the rate of flow of a fluid through a pipe. It also works on the same principle as that of venturimeter.



**12. State the momentum principle.**

It states that the net force acting on a fluid mass is equal to the change in momentum of flow per unit time in that direction.

$$\mathbf{F} = \frac{d(m\mathbf{v})}{dt}$$

**13. Define moody diagram.**

The Moody chart or Moody diagram is a graph in [non-dimensional](#) form that relates the [Darcy friction factor](#), [Reynolds number](#) and [relative roughness](#) for fully developed [flow](#) in a circular pipe. It can be used for working out pressure drop or flow rate down such a pipe.

**14. Give the expression for Darcy weisbach equation.**

$$h_f = f \frac{l V^2}{d 2g};$$

Where

hf = loss of head due to friction

f = friction factor

l = length of pipe, d = diameter of pipe

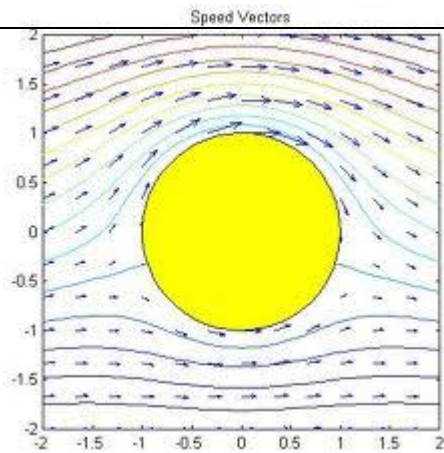
V = velocity of flow, g = acceleration due to gravity.

**15. Define**

- (i) **Stream line**
- (ii) **Path line**
- (iii) **Streak line**
- (iv) **Time line**

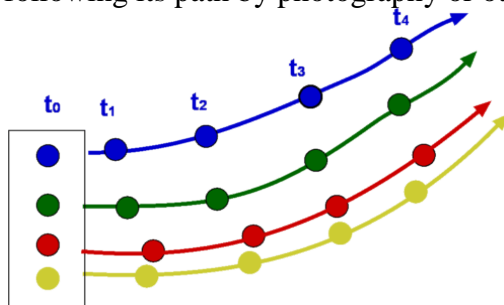
**(i) Stream line:**

Stream line is the path traced out by a mass less particle moving with the flow. Velocity is tangent to stream line at every point.



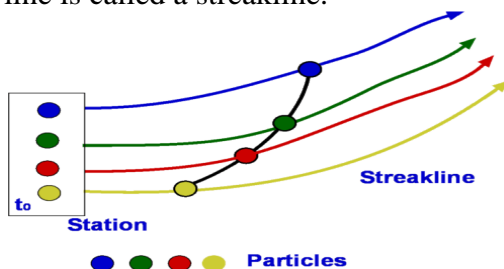
**(ii) Path line:**

Pathline is the line traced by a given particle. This is generated by injecting a dye into the fluid and following its path by photography or other means.



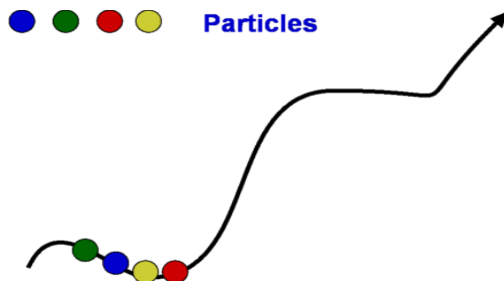
**(iii) Streak line:**

Streakline concentrates on fluid particles that have gone through a fixed station or point. At some instant of time the position of all these particles are marked and a line is drawn through them. Such a line is called a streakline.



**(iv) Time line:**

Timeline is generated by drawing a line through adjacent particles in flow at any instant of time.



**16. Distinguish between stream line and path line.**

Stream line	Path line

A stream line is an imaginary line drawn in a flow field such that a tangent drawn at any point on this line represents the direction of the velocity vector. Path line is the line traced by a single fluid particle as it moves over a period of time.	Stream line shows the direction of velocity of a number of fluid particles at the same instant of time. Path line shows the direction of velocity of the same fluid particle at successive instants of time.
--	--

**17. Can the path line and a streamline cross each other at right angles?**

A fluid particle always moves tangent to the streamline. In steady flow, the path lines and streamlines are identical. In unsteady flow, a fluid particle follows one stream line at one instant and another at the next instant and so on, so that the path line have no resemblance to any given instantaneous streamline.

**18. Define convective and local acceleration.**

**Convective acceleration:**

It is defined as the rate of change of velocity due to the change of position of fluid particles in a fluid flow.

**Local acceleration:**

It is defined as the rate of increase of velocity with respect to time at a given point in a flow field.

**19. Define stream function.**

It is defined as the scalar function of space and time, such that its partial derivative with respect to any direction gives the velocity component at right angles to that direction.

**20. Define boundary layer thickness.**

It is defined as the distance from the boundary of the solid body measured in the y-direction to the point, where the velocity of the fluid is approximately equal to 0.99 times the free stream velocity of the fluid.

## UNIT-4

### BOUNDARY LAYER

**1. What do you meant by viscous flow?**

A flow is said to be viscous if the Renold's number is less than 2000 (or) the flows in layers ie. Re < 2000.

**2. Define kinetic energy correction factor?**

Kinetic energy factor is defined as the ratio of the kinetic energy of the flow per sec based on actual velocity across a section to the kinetic energy of the flow per sec based on average velocity across the same section. It is denoted by ( $\sigma$ ).

K. E factor ( $\sigma$ ) = K.E per sec based on actual velocity / K.E per sec based on Average velocity.

**3. Define momentum correction factor .**

It is defined as the ratio of momentum of the flow per sec based on actual velocity to the momentum of the flow per sec based on average velocity across the section.

It is denoted by ( $\beta$ ) =  $\frac{\text{Momentum per sec based on actual velocity}}{\text{Momentum per sec based on average velocity}}$

**4. Give the expression for the loss of head due to friction in viscous flow.**

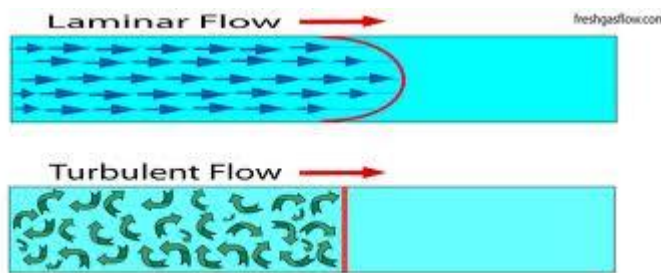
Loss of head due to friction in viscous flow  $f = 16/Re$

Where  $f$  = coefficient of friction between the pipe and fluid

$Re$  = Renolds number.

##### 5. Differentiate between laminar flow and turbulent flow.

Laminar flow	Turbulent flow
A flow is said to be laminar if Reynolds number is less than 2000 is known as laminar flow.	A flow is said to be turbulent if Renolds number is greater than 4000 is known as Turbulent flow .
Laminar flow is possible only at low velocities and high viscous fluids .	Is the flow is possible at both velocities and low viscous fluid .
In such type of flow fluid particle moves in laminas or layers gliding smoothly over the adjacent layer .	In that type of flow fluid particle move in a zig – zag manner .



##### 6. What is the expression for head loss due to friction in Darcy formula?

$$h_f = 4fLV^2 / 2gD$$

Where,

$f$  = Coefficient of friction in pipe

$L$  = Length of the pipe

$D$  = Diameter of pipe

$V$  = velocity of the fluid

##### 7. What are the factors influencing friction loss in pipe flow?

Frictional resistance for the turbulent flow is

- Proportional to  $vn$  where  $v$  varies from 1.5 to 2.0.
- Proportional to the density of fluid.
- Proportional to the area of surface in contact.
- Independent of pressure.
- Depend on the nature of the surface in contact.

##### 8. Give the equation for average velocity.

The equation for average velocity is given as

$$U = \mu (-\partial p / \partial x) R^2$$

Where

$R$  = Radius of the pipe

##### 9. Give the formula for velocity distribution.

The formula for velocity distribution is given as

$$U = \frac{1}{4} \mu (-\partial p / \partial x) (R^2 - r^2)$$

Where

$R$  = Radius of the pipe

$r$  = Radius of the fluid element



**10. What do you understand by the terms a) major energy losses , b) minor energy losses**

**Major energy losses :-**

This loss due to friction and it is calculated by Darcy weis bach formula and chezy's formula

**Minor energy losses :-**

This is due to

- i. Sudden expansion in pipe .
- ii. Sudden contraction in pipe .
- iii. Bend in pipe .
- iv. Due to obstruction in pipe .

**11. How will you determine the loss of head due to friction in pipes?**

**Darcy weis-bach equation**

$$h_f = 4fLV^2 / 2gD$$

Where,  $h_f$  = Loss of head due to friction .

$f$  = Coefficient of friction in pipe .

$D$  = Diameter of pipe .

$L$  = Length of the pipe

$V$  = Mean velocity of flow .

**Chezy's formula**

$$V = C \sqrt{mi}$$

Where

$$i = h_f / L$$

**12. Give an expression for loss of head due to sudden enlargement of the pipe.**

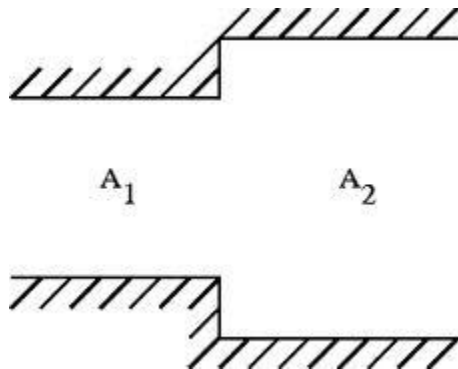
$$h_e = (V_1 - V_2)^2 / 2g$$

Where

$h_e$  = Loss of head due to sudden enlargement of pipe .

$V_1$  = Velocity of flow at section 1-1

$V_2$  = Velocity of flow at section 2-2



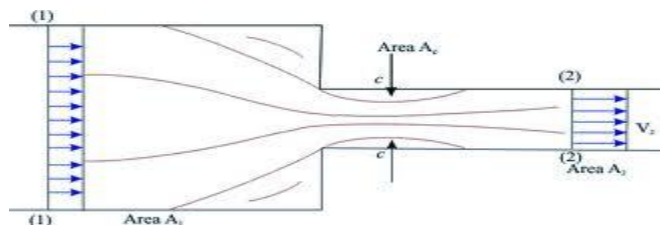
**13. Give an expression for loss of head due to sudden contraction.**

$$h_c = 0.5 V^2 / 2g$$

Where

$h_c$  = Loss of head due to sudden contraction .

$V$  = Velocity at outlet of pipe.



**14. Give an expression for loss of head at the entrance of the pipe.**

$$h_i = 0.5V^2/2g$$

where

$h_i$  = Loss of head at entrance of pipe .

$V$  = Velocity of liquid at inlet and outlet of the pipe .

**15. Derive the expression for drop of pressure for a given length of a pipe.**

$$P_1 - P_2 = 32 \mu UL / gD^2$$

Where

$P_1 - P_2$  is drop of pressure.

**16. Give expression for coefficient of friction in terms of shear stress.**

$$f = 2i_o / \rho v^2$$

Where

$i_o$  = Shear stress

$v$  = velocity of pipes

$f$  = coefficient of friction

**17. Give an expression for loss of head due to an obstruction in pipe.**

Loss of head due to an obstruction

$$= V^2 / 2g ( A / C_c (A-a) - 1 )^2$$

Where

$A$  = area of pipe

$a$  = Max area of obstruction

$V$  = Velocity of liquid in pipe

$A-a$  = Area of flow of liquid at section 1-1.

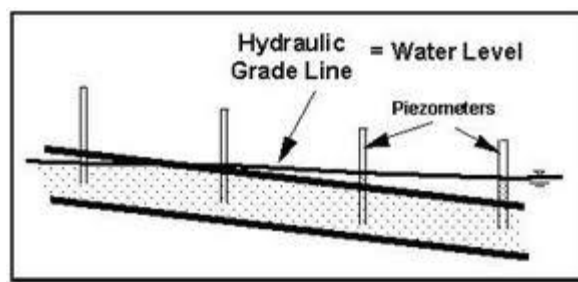
**19. Define the terms**

a) Hydraulic gradient line [HGL]

b) Total Energy line [TEL]

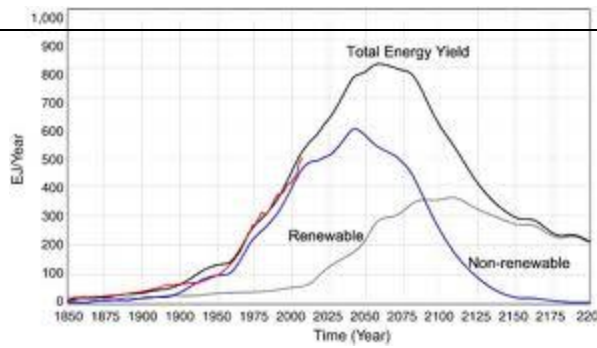
a) Hydraulic gradient line :-

Hydraulic gradient line is defined as the line which gives the sum of pressure head and datum head of a flowing fluid in a pipe with respect the reference line .



b) Total energy line :-

Total energy line is defined as the line which gives the sum of pressure head , datumhead and kinetic head of a flowing fluid in a pipe with respect to some reference line .



## 20. What is syphon? Where it is used?

Syphon is along bend pipe which is used to transfer liquid from a reservoir at a higher elevation to another reservoir at a lower level.

Uses of syphon : -

1. To carry water from one reservoir to another reservoir separated by a hill ridge .
2. To empty a channel not provided with any outlet sluice.

## UNIT-5

### DIMENSIONAL ANALYSIS AND MODEL STUDIES

#### 1. Define dimensional analysis.

Dimensional analysis is defined as a mathematical technique used in research work for design and conducting model tests.

#### 2. What are the fundamental dimensions?

The fundamental units quantities such as length (L), mass (M) and time (T) are fixed dimensions known as fundamental dimensions.

#### 3. Define Units.

Unit is defined as a yardstick to measure physical quantities like distance, area, volume, mass etc.

#### 4. Derive the dimensions for velocity.

Velocity is the distance (L) travelled per unit time (T)

$$\text{Velocity} = \text{distance} / \text{time} = [L/T] = LT^{-1}.$$

#### 5. Define Model.

Model is nothing but small-scale repetition of the actual structure or machine.

#### 6. List out the advantage of model analysis.

The advantages of model analysis are:

1. The performance of hydraulic structure or machine can be easily predicted in advance from its model.
2. The merits of alternative design can be predicted with the help of model testing and the most economical and safe design may be finally adopted.

#### 7. Define similitude.

The three types of similarities are,

1. Geometric similarity
2. Kinematic similarity
3. Dynamic similarity

#### 8. Define Scale ratio.

Scale ratio is the ratio of linear dimension in the model and prototype which are equal in geometric similarity. It is denoted by  $L_r$ .

$$L_r = L_p/L_m = b_p/b_m = D_p/D_m.$$

**9. Define dynamic similarity.**

It means the similarity of forces at corresponding points in the model and prototype is equal.

**10. Give the types of forces in a moving fluid.**

The types of forces in a moving fluid are,

1. Inertia force ( $f_i$ )
2. Viscous force ( $f_v$ )
3. Gravity force ( $F_g$ )
4. Pressure force ( $F_p$ )
5. Surface tension ( $F_s$ )
6. Elastic force ( $F_e$ )
- 7.

**11. Define dimensionless numbers.**

Dimensionless numbers are the numbers obtained by dividing inertia force or gravity force or pressure force or elastic force or surface tension. They are called as non-dimensional parameters.

**12. Define pressure force.**

Pressure force is the product of pressure intensity and cross-sectional area of the flowing fluid in case of pipe flow.

**13. Define elastic force.**

Elastic force is defined as the product of elastic stress and the area of flowing fluid.

**14. Give the types of dimensionless numbers.**

The types of dimensionless numbers are :

1. Reynold's number
2. Froude's number
3. Euler's number
4. Weber' number
5. Mach's number

**15. Define Reynolds's number.**

Reynold's number is defined as the ratio of inertia force of flowing fluid and viscous force of the fluid. It is denoted by (Re).

$$Re = V \times d / \nu = \rho V d / \mu$$

**16. Define Froude's number.**

Froude's number is defined as square root of ratio of inertia force of flowing fluid to gravity. It is denoted as  $Fe = \sqrt{F_i / f_g} = V / \sqrt{Lg}$

**17. Give the classification of models.**

- i. Undistorted models
- ii. Distorted models

**18. What is an undistorted model?**

If the scale ratio for the linear dimensions of the model and prototype is same, then the model is said to be undistorted model.

**19. What is distorted model?**

A distorted model is said to be a distorted model only when it is not geometrically similar to prototype.

**20. Define Weber's model laws.**

When surface tensile forces alone are predominant a model may be taken to be dynamically similar to the prototype when ratio of inertial to the surface tensile forces is the same in the model and prototype.

**16 MARK QUESTIONS**

**UNIT -1**

**FLUID PROPERTIES AND FLUID STATICS**

1. One liter of crude oil weighs 9.6 N; calculate its specific weight, density, specific volume and specific gravity.
2. In a stream of glycerin in motion, at a certain point the velocity gradient is 0.25 meter per sec per meter. The mass density of fluid is 1268.4 kg per cubic meter and kinematics viscosity is  $6.30 \times 10^{-5}$  square meter per second. Calculate the shear force at that point.
3. What do you understand by the terms isothermal process and adiabatic process?
4. Determine the minimum size of glass tubing that can be used to measure water level, if the capillary rise in the tube is not to exceed 0.25 mm. take surface tension of water in contact with air as 0.0732N/m.
5. Determine the bulk modulus of elasticity of a liquid, if as the pressure of the liquid is increased from 7 MN/m<sup>2</sup> to 13MN/m<sup>2</sup> the volume of liquid decreased by 0.15%.
6. Determine the mass density, specific volume and specific weight of a liquid whose specific gravity is 0.85.
7. A cylindrical shaft of 90mm rotates about a vertical axis inside a cylindrical tube of length 50 cm and 95 cm internal diameter. If the space between them is filled with oil of viscosity 2 poise find the power lost in friction for a shaft speed of 200rpm.
8. Obtain an expression for capillary rise of a liquid.
9. Define surface tension and obtain the relationship between surface tension and pressure inside a droplet of liquid in excess of outside pressure.
10. Find the surface tension in a soap bubble of 30mm diameter when the inside pressure is 1.962 N/m<sup>2</sup> above atmosphere.

**UNIT -2**

**FLUID KINEMATICS AND DYNAMICS**

1. A solid wood cylinder is with a diameter of 0.666 m and a height of 1.3 m. the specific gravity of the wood is 0.61. Would the cylinder be stable if placed vertically in oil of specific gravity 0.85?
2. Give the definitions of metacentre and metacentric height.
3. Derive the equation of continuity for three dimensional incompressible fluid flows and reduce it to one dimensional form.

4. A hollow cylinder closed at both ends has an outside diameter of 1.25m, length 3.5m and specific weight 75KN/m<sup>3</sup>. if the cylinder is to float just in stable equilibrium in sea water (specific weight 10 KN/m<sup>3</sup>) , find its minimum permissible thickness.
5. What is a flow - net"? Enumerate the methods of drawing flow nets. What are the uses and limitations of flow nets?
6. State and prove the hydrostatic law.
7. Determine the gauge and absolute pressure at a point which is 2m below the free surface of water. Take atmospheric pressure as 10.1093n/m<sup>2</sup>.
8. A rectangular tank 4m long, 1.5m wide contains water up to a height of 2m. Calculate the force due to water pressure on the base of the tank. Find also the depth of centre of pressure from free surface.
9. A block of wood of specific gravity 0.7. Floats in water. Determine the meta-centric height of the block if its size is 2mx1mx0.8m.
10. A 25cm diameter pipe carries oil specific gravity 0.9 at a velocity of 3m/s. at another section the diameter is 20cm. find the velocity at this section and also mass rate of flow of oil

### UNIT -3 FLOW THROUGH PIPES

1. The water is flowing through a pipe having diameters 200 mm and 100 mm at sections 1 & 2 respectively. The rate of flow through the pipe is 35 l/s. the section 1 is 2 m above datum and section 2 is 4 m above datum. If the pressure at section 1 is KN/m<sup>2</sup>, find the intensity of pressure at section 2.
2. Derive Euler's equation of motion along a stream line and hence derive the Bernoulli's theorem.
3. Derive the Hagen - Poiseuille equation and state the assumptions made.
4. Give the equation for difference of pressure head for laminar flow between two fixed parallel plates with details.
5. Explain in detail about drag and lift coefficients.
6. Briefly explain about Moody's diagram, pipe roughness.
7. A pipe of diameter 400mm carries water at a velocity of 25m/s .the pressure at the points a and b are given as 29.43n/m<sup>2</sup>and 22.563n/m<sup>2</sup> respectively while the datum head at a & b are 28m & 30m. Find the loss of head between a & b.
8. A nozzle of diameter 20mm is fitted to a pipe of diameter 40mm. find the force exerted by the nozzle on the water which is flowing through the pipe at the rate of 1.2m<sup>3</sup>/minute.
9. State Bernoulli's theorem for steady flow of an incompressible fluid.
10. Assumption's of Bernoulli's theorem.

### UNIT -4 BOUNDARY LAYER

1. Derive the expression for momentum thickness of boundary layer.
2. Derive the expression for head loss due to friction for a pipe flow.

3. A 146.3 m long 45.7 cm diameter concrete pipe and a 179.8 m long 30.48 cm diameter concrete pipe are connected in series. Calculate the length of an equivalent of 25.4 cm diameter.
4. Explain briefly pipe network.
5. A crude oil of kinematic viscosity 0.4 stoke is flowing through a pipe of diameter 300mm at the rate of 300 liters per sec. find the head lost due to friction for a length of 50m of the pipe.
6. Find the loss of head when a pipe of diameter 200mm is suddenly enlarged to a diameter of 400mm. the rate of flow of water through the pipe is 250 l/s.
7. At a sudden enlargement of a water main from 240mm to 480mm diameter, the hydraulic gradient rises by 10mm. estimate the rate of flow.
8. A 150mm diameter pipe reduces in diameter abruptly to 100mm. if the pipe carries water at 30l/s. calculate the pressure loss across the contraction. Take the coefficient of contraction as 0.6 .
9. Explain what you understand by boundary layer thickness and displacement thickness. Determine the relationship between the two for a boundary layer which is
  - (i) laminar throughout and
  - (ii) Turbulent throughout
 Assume
  - (i) In the laminar boundary layer, the flow obeys the law, shear stress  $\tau = \mu \frac{du}{dy}$  where  $\mu$  is the viscosity , which leads to velocity profile  $(U - u) = k(\delta - y)^2$  where  $U$  is the free stream ,  $u$  is the velocity at distance  $y$  above the plate and  $k$  is constant.
  - (ii) The Velocity distribution in the turbulent boundary is given by  $\frac{u}{U} = \left(\frac{y}{\delta}\right)^{1/7}$
10. Derive an expression for the calculation of loss of head due to
  - (i) Sudden enlargement
  - (ii) Sudden contraction

## UNIT -5

### DIMENSIONAL ANALYSIS AND MODEL STUDIES

1. Briefly explain Rayleigh's method.
2. Briefly explain Buckingham's  $\pi$ -theorem.
3. The resisting force of a supersonic aircraft during its flight can be assumed to depend on following variables such as length, velocity, viscosity, and density and bulk modulus. With the help of Buckingham  $\pi$  theorem derive an expression showing the relationship between resisting force and these variables.
4. Describe Buckingham's  $\pi$  theorem to formulate a dimensionally homogenous equation between the various physical quantities effecting a certain phenomenon.
5. By dimensional analysis, show that the power  $P$  developed by a hydraulic turbine is given by  $P = \rho N^3 D^5 f\left(\frac{N^2 D}{gH}\right)$  where  $\rho$ - mass density of liquid ,  $N$ - rotational speed ,  $D$ - diameter of runner ,  $H$  – working head ,  $g$ - acceleration due to gravity.

6. The resistance 'R' is experienced by a partially submerged body depends upon the velocity 'V', length of the body 'l', viscosity of fluid ' $\mu$ ', density of the fluid ' $\rho$ ' and gravitational acceleration 'g'; Obtain the dimensionless expression for R.
7. State the reasons for constructing distorted models. What are the merits and demerits of distorted models compared to undistorted models?
8. The resisting force (R) of the supersonic flight can be considered as dependent upon the length of the aircraft 'l', velocity 'v', air viscosity ' $\mu$ ', air density ' $\rho$ ' and the bulk modulus of air 'k'. express the functional relationship between these variables and the resisting force.
9. Explain the Reynolds's law of similitude and Froude's law of similitude.
10. In an aero plane model of size (1/10) of its prototype, the pressure drop is  $7.5 \text{ kN/m}^2$ . The model is tested in water. Find the corresponding pressure drop in the prototype. Assume density of air =  $1.24 \text{ kg/m}^3$ , density of water =  $1000 \text{ kg/m}^3$ , viscosity of air =  $0.00018 \text{ poise}$  and viscosity of water =  $0.01 \text{ poise}$ .

### ASSIGNMENT QUESTIONS

1. Explain the Applications of Fluid Mechanics in Engineering Projects.
2. Detailed notes on Capillary Action and Examples.
3. Measurement of low pressures using manometers
4. Explain the term Surface Tension and its Practical Applications.
5. What are the Applications of Buoyancy and explain them?
6. Derive the Hagen poiseuille's equation and write the use of the equation.
7. What are the Applications of Pitot Tube in fluid mechanics?
8. Explain the Use of Fluid Mechanics in Civil Engineering.
9. What is the principle used for working of Venturimeter and Its Applications?
10. Application of laminar and turbulent flow
11. The use of the Moody diagram in engineering
12. Boundary Layer Control and Its Applications.
13. Explain the applications of Piezometer, Drag force, In viscous flow.
14. Derive the Displacement thickness, Momentum thickness and Energy thickness.
15. Define Buckingham's ' $\pi$ ' theorem and explain the use of Buckingham's ' $\pi$ ' theorem in the dimensional analysis.



# **GE6351 ENVIRONMENTAL SCIENCE AND ENGINEERING**

## **UNIT I – ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY**

### **1. Define environment.**

Environment is defined as the sum of total of all the living and non-living things around us influencing one another.

### **2. What are all the categories of environment?**

The main categories of environment are biotic and abiotic environments. The abiotic environment can further be classified into atmosphere (air), lithosphere (soil), and hydrosphere (water). The biotic environment is called as biosphere.

### **3. Write the components of environment?**

Air (Atmosphere)

Land (Lithosphere)

Water (Hydrosphere)

### **4. Define ecosystem.**

A group of organisms interacting among themselves and with environment is known as ecosystem. Thus an ecosystem is a community of different species interacting with one another and with their nonliving environs exchanging energy and matter.

### **5. List any four characteristics of ecosystem.**

(i). Ecosystem is the major ecological unit.

(ii). It contains both biotic and abiotic components.

(iii). The boundary of the ecosystem is not rigidly defined and it is flexible.

(iv). Through the biotic and abiotic components nutrient cycle and energy flow occur.

### **6. What are the different types of ecosystem**

1. Natural Ecosystem

2. Artificial Ecosystem

3. Incomplete Ecosystem

### **7. Write about autotrophic organisms.**

The producers are plants and bacteria, capable of producing their own food photosynthetically or by chemical synthesis. These organisms are, thus, self-nourishing as they can produce the as they can produce their own food by using the energy from the physical environment surrounding them .them are also know as autotrophic organism or producer.

## **8. Write about heterotrophic organisms**

These organisms depend on other animals or on the food produced by other organisms for their nourishment, they are also called as heterotrophic organisms or consumers.

## **9. What do you know about food chain and food web?**

A food chain is a picture or model that shows the flow of energy from Autotrophs to a series of organisms in an environment. The network like interaction of organisms is called as food web.

## **10. Define food chain.**

The sequence of eating and being eaten in an ecosystem is known as food chain or transfer of food energy from the plant through a series of organisms is referred to as food chain.

## **11. Name three types of food chains.**

a. Grazing food chain b. Detritus or Decomposer food chain c. Parasitic food chain

## **12. Define food web.**

The interlocking pattern of various food chain in an ecosystem is known as food web.

## **13. Define ecological pyramids.**

Graphical representation of structure and function of trophic levels of an ecosystem, starting with producers at the bottom and each successive trophic levels forming the apex is known as an ecological pyramids.

## **14. Define primary succession.**

The succession taking place in areas that have not already been occupied by any community is known as primary succession.

## **15. Define secondary succession.**

Development of a new community in an area where the previously existing community was removed and the ecological conditions are favourable is termed as secondary succession.

## **16. Define biodiversity.**

Biodiversity is defined as the variety and variability among all group of living organisms and the ecosystem in which they occur.

## **17. What are the three types of biodiversity?**

1. Genetic Level or Genetic diversity
2. Species Level or Species diversity
3. Ecosystem Level or Ecosystem diversity.

**18. Define genetic diversity.**

Genetic diversity is the variation of genes within species. Genes are the basic units of all life on earth. They are responsible for both the similarities and the differences between organisms.

**19. Define species diversity.**

Species diversity is the number of different species of living things available in an area. Species is a group of plants or animals that are similar and able to breed and produce viable offspring under natural conditions. This type of diversity is the most common level of diversity.

**20. Define ecosystem diversity.**

Ecosystem diversity is the variety of ecosystems in a given place. An ecosystem is a community of organisms and their physical environment interacting together. An ecosystem can cover a large area, such as a whole forest, or a small area, such as a pond.

**21. What are the two main functions of biodiversity?**

- a. It is the source of species on which the human compete depends for food, fiber, shelter, fuel and medicine.
- b. It depends on the biosphere, which in turn leads to the stability in climate, water, soil, air, and the overall health of biosphere.

**22. Define biogeography.**

The study of the geographical distribution of biological species relating to the geological, evolutionary, climatological, geographical, biological reasons for the distribution is called biogeography. Define biogeography. The study of the geographical distribution of biological species relating to the geological, evolutionary, climatological, geographical, biological reasons for the distribution is called biogeography.

**23. Biodiversity hotspots are areas:**

- i. Rich in plant and animal species, particularly many endemic species, and
- ii. Under immediate threat from impacts such as land clearing, development pressures, salinity, weeds and feral animals.

**24. List some of the major biodiversity threats.**

- a. Habitat destruction.
- b. Extension of agriculture.
- c. Filling up of wetlands.
- d. Conversion of rich bio-diversity site for human settlement and industrial development.

**25. What do you know about conservation of biodiversity?**

Conservation is defined as the management of human use of the biosphere so that it may yield the greatest sustainable benefit while maintaining its potential to meet the needs and aspirations of future generations”.

**26. What are the two types of biodiversity conservation?**

- a. In-situ conservation
- b. Ex-situ conservation

**27. What is endemic species?**

The species, which are found only in particular region are known as endemic species

**28. Define in-situ conservation.**

In-situ conservation involves protection of fauna and flora within its natural habitat, where the species normally occurs is called in-situ conservation.

**29. Define ex-situ conservation.**

Ex-situ conservation involves protection of fauna and flora outside the natural habitats.

## **UNIT II – ENVIRONMENTAL POLLUTION**

**1. Define pollution.**

Environmental pollution may be defined as the unfavorable alteration of our surroundings its change the quality of the air, water and land which interferes with the health of humans and other life on earth.

**2. Types of pollutants.**

Biodegradable pollutants

Non-biodegradable pollutants

**3. Define air pollution.**

Air pollution is defined as the presence of one or more contaminates like dust, smoke, mist and odor in the atmosphere which are injurious to human beings, plants and animals.

**4. What are the different sources of air pollution?**

The two main sources of air pollution are a. Natural Sources.

Natural sources include dust storms, volcanoes, lightening sea salt, smoke, and forest fires.

b. Man made or anthropogenic sources.

The man made sources are agricultural activities, industrial growth, domestic wastes, automobile exhausts, etc.

**5. Define photo chemical smog.**

A photochemical reaction is any chemical reaction activated by light that air pollution known as photochemical smog is a mixture of more than 100 primary and secondary pollutants formed under the influence of sunlight. Its formation begins inside automobile engines and the boilers and in coal-burning power and industrial plants.

**6. What do you know about particulate?**

In general the term „particulate“ refers to all atmospheric substances that are not gases. They can be suspended droplets or solid particles or mixtures of the two. Particulates can be composed of materials ranging in size from 100mm down 0.1 mm and less. The chemical composition of particulate pollutants is very much dependent upon the origin of the particulate.

**7. Define suspended particulate matter**

Suspended Particulate Matter (SPM) is a complex mixture of small and large particles with size less than 100u varying origin and chemical composition.

**8. Differentiate between Mist and Fog.**

Mist is made up of liquid droplets generally smaller than 10um which are formed by condensation in the atmosphere or are released from industrial operations.

Fog is similar to mist but the droplet size bigger (> 10u) and water is the liquid. Fog is sufficiently dense to impede vision.

**9. What are effects of air pollution on animals?**

Animals take up fluorides of air through plants. Their milk production falls and their teeth and bones are affected. They are also prone to lead poisoning and paralysis.

**10. List some of the effects of air pollution on physical properties of atmosphere.**

- a. Decrease in the visibility
- b. Reduction of Solar radiation.
- c. Effects on weather conditions.
- d. Effects on atmospheric constituent.

**11. Briefly describe about the impacts of carbon monoxide on human health.**

At lower doses, they can impair concentration and neurobehavioral function whereas in higher doses they can cause heart pain and even death. When inhaled it has the ability to combine with haemoglobin of blood and reduce its ability in transfer of oxygen to the brain, heart, and other important organs. But carboxyhaemoglobin contents of blood depend on the CO contents of the air inhaled, time of exposure and the activity of the person inhaling. It is particularly dangerous to babies and people with heart disease.

**12. How air pollution can be controlled at source?**

- a. Proper use of the existion equipment
- b. Change in process.
- c. Modification or Replacement of equipments.
- d. Installation of controlling equipments.

**13. Define water pollution.**

Water pollution may be defined as the alteration in physical, chemical and biological characteristics of water which may cause harmful effects on humans and aquatic life.

**14. What are the effects of in organic substances in water?**

- a. Makes the water unfit for drinking and other purposes.
- b. Corrosion of metals exposed to such waters.
- c. Causes skin cancers, damages to spinal,CNS, liver and kidneys.
- d. Reduces crop yield.

**15. How do the nutrients from agricultural fields affect the watershed?**

Enrichment of nutrients (Eutrophication) from surrounding watershed affects the penetration of light through the water, causing damage to the characteristic of water and aquatic life.

**16. Define soil pollution.**

Soil pollution is defined as the contamination of soil by human and natural activities which may cause harmful effects on living beings.

**17. Define marine pollution.**

Marine pollution is defined as the discharge of waste substance into the sea resulting in harm to living resource, hazards to human health, hindrance to fishery and impairment of quality for use of sea water.

**18. Define noise pollution.**

Noise pollution is defined as the unwanted, unpleasant or disagreeable that causes discomfort for all living beings.

**19. What is the cause of noise pollution?**

- a. Road traffic noise
- b. Air traffic noise
- c. Rail traffic noise
- d. Domestic noise
- e. Industrial noise
- f. Incompatible land use.

**20. Define thermal pollution.**

Thermal pollution is defined as the addition of excess of undesirable heat to water that makes it harmful to man, animal or aquatic life or otherwise causes significant departures from the normal activities of aquatic communities in water.

**21. What are solid wastes?**

The wastes generated and discarded from human and animal activities that are normally solid are called as solid wastes.

**22. What are solid know about on –site handling?**

The activities involved in handling of solid wastes, at the point of generation, until they are placed in the containers used for their storage before collection are called as on –site handling. Handling requires to move the filled containers to the collection point and to return the empty containers to the generation point for the next collection.

**23. What is the purpose of on-site processing?**

On-site processing of solid wastes is used to recover the reusable materials from the solid wastes. This process also helps in reducing the volume of solid wastes or altering the physical form of the solid wastes.

**24. What are the types of municipal solid wastes collection system?**

1. Hauled container.
2. Stationary container systems.

**25. What are the main purposes of processing techniques used in solid waste management?**

- a. To improve the efficiency of solid waste management systems
- b. To recover the usable materials for reuse.
- c. To recover conversion products and energy.

**26. List out the techniques of processing of solid wastes.**

- a. Compaction (Mechanical volume reduction)
- b. Incineration (Chemical volume reduction)
- c. Shredding (Mechanical size reduction)
- d. Component separation
- e. Drying and Dewatering (Moisture content reduction).

**27. Name some of the mechanical separation methods of solid wastes?**

- a. Air separation
- b. Magnetic separation
- c. Screening

**28. List out the three types of system used in the collection of wastewater.**

- a. Separation System
- b. Combined System
- c. Partially Separate system.

**29. What is the main objective of sludge digestion?**

The main objective of sludge digestion is to break the organic matter of the sludge into liquid and simple compounds which are stable and unfold in nature.

**30. How can you define hazardous wastes?**

Wastes that create danger to the living community, immediately or over a period of time, are called as hazardous wastes.

**31. What are biomedical wastes?**

Biomedical wastes are defined as any solid, semi solid or liquid waste including its containers and any intermediate product which are generated during diagnosis, treatment or immunization of human being/ animals or in production and testing of biological parts.

**32. Can you list out some of the benefits of pollution prevention?**

- a. Minimizes health risks.
- b. Reduces the production of pollutants to a minimum or eliminates them.
- c. Accelerates the reduction or elimination of pollutants.
- d. Helps avoid transferring pollutants from one medium to another, thereby preventing diffusion in the environment.
- e. Helps promote a more effective use of energy, materials and resources.

**UNIT III – NATURAL RESOURCES**

**1. Define renewable resources.**

The renewable resources are those resources which have the inherent capacity to reappear, or replenish themselves by quick recycling , reproduction, and replacement within a reasonable time ,and to maintain themselves. Example; air, water, soil (land), and plants, and animals

**2. Define non-renewable resources.**

The non-renewable resources are those that do not have the ability for recycling and replacement within a reasonable period of time.

Example; minerals, coal oil, natural gas, ground water

**3. List some of the renewable energy sources.**

- a. Solar energy
- b. Wind energy
- c. Hydro energy
- d. Geo-thermal energy
- e. Ocean thermal energy

**4. Define deforestation.**

Deforestation is the process of removal of (or) elimination of forest resources due to many natural or man-made activities. in general deforestation means destruction of forests.



## **5. What is mining?**

Mining is the process of extracting mineral resources and fossil fuels like coal from the earth. These deposits are found in the forest region and any operation of mining will naturally affect the forest. mining operation requires removal of vegetation along with underlying soil mantle.

## **6. Define drought.**

Drought is nothing but scarcity of water, which occurs due to inadequate rainfall, late arrival of rains and excessive withdrawal of ground water.

## **7. Define food resources.**

Food is an essential requirement for the human survival. Each person has minimum food requirement, the main components of food are carbohydrates, fats protein, minerals, and vitamins.

## **8. Uses of forest.**

- a. Wood used as fuel.
- b. Various industries. Used raw materials as pulp ,paper, board , timber
- c. Many plants are utilized in preparing medicines and drugs
- d. Forests products, like gums resins, dyes.

## **9. Types of mining.**

### **a. surface mining :**

It involves mining of minerals from the shallow deposits.

### **b. underground mining:**

It involves mining of minerals from deep deposits.

## **10. What is hydrological cycle?**

The water from various water bodies gets evaporated by the solar energy, and falls again on the earth in the form of rain or snow and enter into the living organisms and plants and ultimately returns to the ocean .this process is called hydrological cycle.

Clouds →water (ocean, lake, river) →living organisms &plants

## **11. Define floods.**

A flood is an overflow of water, whenever the magnitude of flow of water exceeds the carrying capacity of the channel within its banks.

## **12. Cases of flood.**

- a. Heavy rainfall, melting of snow (ice), sudden release of water from dams, often causes floods in the low-lying coastal area.
- b. Prolonged downpour can also cause the over-flowing of lakes and rivers resulting into floods.
- c. The removal of dense and uniform forest cover over the hilly zones leads to occurrence of floods.

**13. List some of the food resources available in the world.**

Major food sources available in the world to cater the human's hunger are 12 types of seeds and grains, 3 root crops, 20 common fruits and vegetables, 6 mammals, 2 domestic fowl, few fishes and other forms of marine life etc.

**14. Define Traditional Agriculture.**

Traditional Agriculture can be classified as Traditional Subsistence agriculture and Traditional Intensive agriculture. Traditional Subsistence agriculture produces enough crops or live stock for a farm family's survival and in good years, a surplus to sell or put aside for hard times. In Traditional Intensive agriculture farmers increase their inputs of human and draft labour, fertilizer, and water to get a higher yield per area of cultivated land to produce enough food.

**15. Write the advantages and disadvantages of petroleum as a energy resources?**

As a source of energy petroleum has many advantages

- a. It is relatively cheap to extract and transport
- b. It requires little processing to produce desired products and
- c. It has relatively high net and useful energy yield.

However it has certain disadvantages also,

- a. Produces Environmental pollution
- b. Oil spills, in ocean cause water pollution and is expensive to clean up.

**16. Write short notes on Tidal energy.**

Tides, the alternate rise and fall of sea water possess lot of energy. The identified tidal power potential in India is around 9000 MW. Currently France, Russia, china and Canada are effectively utilizing the tidal energy to produce 2 to 3% of their energy demand.

**17. Define Soil Erosion.**

Soil erosion is the movement of soil components, especially surface litter and top soil, from one place to another. The two main movers are flowing water and wind.

**18. List some ways to protect soil.**

- a. When the buildings are constructed, all the trees shall be saved.
- b. Setting a composite bin and it shall be used for producing mulch and soil
- c. Conditioner for yard and garden plantso organic methods can be used for growing vegetables.
- d. Strictly enforcing laws and policies that minimize soil erosion, salt buildup and water logging.

**19. What is equitable use of resources?**

The Equitable use of resources is a concept that deals with the rational use of resources so that a harmony between man's resource requirement and its availability can be established.

**20. Define drought.**

Drought is nothing but scarcity of water which occurs due to inadequate rainfall, late arrival of rains and excessive withdrawal of ground water.

**21. Give the classification of Mineral Resources.**

Energy resources(coal, oil, natural gas, uranium, and geothermal energy; metallic mineral resources (iron, copper and aluminum) and nonmetallic minerals resources (salt, gypsum and clay, sand, phosphates, water, and soil).

**22. Write short note on blue baby syndrome.**

When the nitrogenous fertilizers are applied in the fields they leach deep into the soil the contaminate the ground water. the nitrate concentration in the water gets increased. When the nitrate concentration exceeds 25mg /lit they cause series health problems called blue baby syndrome this disease affects infants and leads even to death.

**23. Define energy.**

Energy may be defined as any property, which can be converted into work (or) the capacity to do work.

**24. Write short notes on petroleum gas.**

It is the mixture of three hydrocarbons butane, propane and ethane. The main constituent of petroleum gas is butane. The above gases are in gaseous state in ordinary pressure but they can be liquefied under high pressure. So it is called as LPG. (Liquefied petroleum Gas).

A domestic cylinder contains 14 kg of LPG. A strong smelling substance called ethyl mercaptan is added to LPG gas cylinder to help in the detection of gas leakage.

**25. List some of the renewable energy sources.**

- a. Solar energy
- b. Wind energy
- c. Hydro energy
- d. Geo-thermal energy
- e. Ocean thermal energy
- f. Biogas

**26. Define wind energy.**

Moving air is called wind. Energy recovered from the force of the wind is called wind energy. The energy possessed by wind because of its high speed. The wind energy is harnessed by making use of wind mills.

**27. What is ote?**

There is often large temperature difference between the surface level and deeper level of the tropical oceans. This temperature difference can be utilized to generate electricity. The energy available due to the difference in temperature of water is called ocean thermal energy.

**28. Define geo thermal energy.**

Temperature of the earth increases at a rate of 20-75°C per km, when we move down the earth surface. High temperature and high pressure steam fields.

**29. Define LPG.**

The petroleum gas obtained during the cracking and fractional distillation can be easily converted into liquid under high pressure called as LPG. LPG is colorless and odorless gas. But during bottling some mercaptans is added, which produces bad odour.

**30. What is land degradation?**

Land degradation is the process of deterioration of soil or loss of fertility of the soil.

**UNIT IV– SOCIAL ISSUES AND THE ENVIRONMENT**

**1. State the declaration about the sustainable development.**

The Rio declaration states that, “human beings are at the center or concern for sustainable development. They are entitled to a health and productive life in harmony with the nature. Every generation should leave air, water and soil resources without any pollution as pure as it came to the Earth.”

**2. Define sustainable development.**

Sustainable development is defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs.

**3. What are the three important components of sustainable development?**

The three important components of sustainable development are

- a. Economic development (like industrial development, creating job opportunities, utilization of natural resources for developing the quality of life)
- b. Community development (providing food, shelter, cloth, education, and other essentials for the human beings).
- c. Environmental protection (providing clear air, water and environment for the present and future generations and utilization of resources in a sustainable manner).

**4. Define sustainable development indicators**

Sustainable development Indicators (SDI) is various statistical values that collectively measure the capacity to meet present and future needs. SDI will provide information crucial to decisions on national policy and to the general public.

**5. What are the uses of sustainable development indicators?**

The indicators are used by decision makers and the policy makers at all levels in order to monitor the progress towards attaining sustainable development. These are also used to increase focus on the sustainable development.

## **6. Define sustainability.**

Sustainability can be defined as the ability of a society or ecosystem to continue functioning into the indefinite future without being forced into decline through complete loss of its strength or overloading of key resources on which that system depends.

## **7. Define resistance stability and resilience stability.**

Resistance stability is the ability of a system to remain stable in the face of stresses and Resilience stability of the system to recover from the disturbance occurred due to the activities happened.

## **8. Define urbanization.**

Urbanization is defined as „the process movement of human population from rural areas to urban areas in search in search of better economic interests with better education, communication, health, civic facilities and other day to day needs.

## **9. What are problems or discomforts faced by rural people?**

- a. Lack of modernization of agricultural sector.
- b. Lack of job opportunities.
- c. Poor life style.
- d. Poor health facilities Poor education facilities.
- e. Poor transportation facilities.
- f. Poor availability of energy.

## **10.What are the uses of energy in urban areas?**

Energy is used in an urban area for the following.

- a. For industrial activities
- b. For transportation
- c. For water apply
- d. For building & commercial use
- e. For cleaning of pollutants
- f. For essential services.

## **11. Define water conservation.**

The process of saving water for future utilization is known as water conservation.

## **12. Define rain water harvesting.**

Rain water harvesting is a technique of capturing and storing of rainwater for further utilization.

## **13. Define watershed.**

Water shed is defined as the land area from which water drains under the influence of gravity into a steam, lake, reservoir or other body of surface water.

## **14. What do you know about watershed?**

A watershed is defined as the geographic area from which water in a particular stream, lake or estuary originates. It includes entire area of land that drains into the water body. It is separate from other system by high points in the area such as hills or slopes.

**15. What is watershed management?**

Watershed management is a process aimed at protecting and restoring the habitat and water resources of a watershed, incorporating the needs of multiple stakeholders.

**16. What are the impacts of human activities on watershed?**

- a. Alteration of water course
- b. Addition of pollution sources
- c. Urbanization
- d. Securing of channels.

**17. What are the two important principles of watershed management?**

The two important principles of watershed management are:

- a. To preserve the environment, and
- b. To use the most cost-effective means to achieve this goal.

**18. Name some of the factors causing relocation of people.**

- a. Development activities
- b. Natural and man-made disasters
- c. Conservation initiatives.

**19. Define environmental ethics.**

Environmental ethics refers to the issues, principals and guidelines relating to human interactions with their environment.

**20. Define resettlement.**

Resettlement is defined as the process of simple relocation or displacement of human population without considering their individual, community or societal needs.

**21. Define rehabilitation.**

Rehabilitation is defined as the process of replacing the lost economic assets, rebuilding the community system that have been weakened by displacement, attending to the psychological trauma of forced separation from livelihood.

**22. What are the factors that influence climate change on the earth?**

Climate change on the earth is influenced by the following factors.

- a. Variations in the Earth's orbital characteristics.
- b. Atmospheric carbon dioxide variations.
- c. Volcanic eruptions
- d. Variations in solar output.

**23. List out any four effects of climate change.**

Mean sea level is increased on an average of around 1.8mm per year. Many ecosystems of the world have to adapt to the rapid change in global temperature. The rate of species extinction will be increased. Human agriculture, forestry, water resources and health will be affected.

**24. Define green house effect.**

The green house effects may be defined as the progressive warming up of the earth's surface due to blanketing effect of manmade  $\text{CO}_2$  in atmosphere.

**25. Define global warming.**

The increased the inputs of  $\text{CO}_2$  and other green house gases into the atmosphere from human activities will enhance the earth's natural green house effects of raising the average global temperature of the atmosphere near the surface. This enhanced the green house effect is called warming.

**26. How can global warming are controlled.**

- a. Reduction in consumption of fossil fuel such as coal and petroleum.
- b. Use of biogas plants.
- c. Use of nuclear power plants.
- d. Increasing forest cover.
- e. Use of unleaded petrol in automobiles.
- f. Installation of pollution controlling devices in automobiles and industries.

**27. Define acid rain.**

Normally rain water is always slightly acidic because of the fact that  $\text{CO}_2$  present in the atmosphere gets dissolved on it. Because of the presence the of  $\text{SO}_2$  and  $\text{NO}_2$  gases as pollutants in the atmosphere, the pH of the rain water is further lowered. This type precipitation of water called acid rain or acid deposition.

**28. List any four impacts of acid rain.**

- a. Both dry and wet deposition of sulphur dioxide significantly increases the rate of corrosion of lime stone, sand and marble.
- b. Forest tree population is effected by acid rain.
- c. Acid rain in combination with ozone may damage the wxy coating on leaves and needles. This may weaken or damage them and provide opportunities for disease to enter the tree.
- d. Acid rain may change the characteristics of soil and eventually pollute the streams and lakes.

**29. Define wet deposition and dry deposition. Is there any difference in damage due to these two types of deposition?**

Wet deposition refers to acidic rain, fog, and snow. As this acidic water flowers over and through the ground, it afferts plants and animals in many ways. Dry deposition refers to acidic gases and particles. About half of the acidity in the atmosphere falls back to earth through dry deposition. Both wet and dry deposition can cause the same damage.

**30. How can we minimize the formation of acid rain?**

- a. By reducing pollution from industries,
- b. By using other sources of energy,
- c. By using cleaner automobiles.

**31. Define ozone layer.**

Ozone is a gas  $O_3$  found thorough the atmosphere but most highly concentration in the stratosphere between 10 and 50 km above sea level, which it is known as the ozone layer.

**32. Name any three most important types of CFC which are responsible for ozone depletion.**

- a. Trichlorofluoromethene,
- b. Dichlorodifluoromethane,
- c. 1, 1, 2 Trichlorotrifluoroethane.

**33. What are the harmful effects of ozone layer depletion on human beings?**

- a. Reddening of skin in sun shine (Sun burn)
- b. Skin Cancer.
- c. Reduction in body's immunity to disease.
- d. Eye disorders like Cataracts and Blindness.

**34. Define waste land.**

Waste lands are defined as the lands which re unstable in ecologically and topographically with complete loss or its fertility status. In these types of lands the toxicity for the growth of crops or trees are developed due to environmental or anthropogenic problems.

**35. What are the causes for formation of waste land?**

- a. Deforestation.
- b. Desertification.
- c. Soil loss.
- d. Industrial pollution.

**36. What is the need for waste land reclamation?**

Population of the world is increasing at an alarming rate. This increases demand for food and demand of land for shelter and other resources. The available land area should be properly utilized for making food for increasing population of the world.



## **UNIT V – HUMAN POPULATION AND THE ENVIRONMENT**

### **1. How the population problem in India is analyzed?**

India's population problem may be viewed from three aspects

- a. The absolute size of population.
- b. The rate of growth of the population.
- c. The age structure of the population.

### **2. What is population explosion?**

Population explosion means the rapid population growth which is unexpected and unimaginable. The graph of recent population growth is referred to as a „J“ curve as it follows the shape of that letter, starting out low and skyrocketing straight up.

### **3. List the effect of population explosion.**

- a. Increased consumption of resources available in the environment and depletion of the same quickly.
- b. Due to over –consumption of natural resources, the environment gets deteriorated and polluted.
- c. There will be desertification, deforestation, soil erosion, loss of fertility and poor productivity.
- d. Mass poverty, poor per-capital availability of food for consumption and prevalence of disease on large scale.
- e. Rapid urbanization resulting in growth of slums in cities and towns.

### **4. Define wellness.**

Wellness is a state of optional well being. Wellness emphasizes each individual's responsibility for making decisions that will lead not only to the prevention for disease but to the promotion of a high level of health.

### **5. Name some health related fitness components.**

- a. Muscular strength and endurance.
- b. Flexibility.
- c. Body composition.
- d. Cardio-vascular endurance.

### **6. Define Demography.**

It refers to the science of dealing with the study of size, composition and territorial distribution of population; it includes study of natality, fertility, mortality, migration, and social mobility.

### **7. What is vital statistics?**

Vital statistics are referred to systematically collected and compiled data relating to vital events of life such as birth, death, marriage, divorce, adoption, etc.

**8. Name the fundamental rights of an Indian citizen.**

- a. Right to equality
- b. Right to freedom of Speech and Activity
- c. Right against Exploitation
- d. Right to Freedom of Religion
- e. Cultural and Educational Rights
- f. Right to Constitutional Remedies.

**9. Write short notes on common property resources.**

Our environment has a major component that does not belong to individuals. There are several commonly owned resources that all of us use as a community. The water that nature recycles, the air that we all breathe, the forests and grasslands which maintain our climate and soil, are all common property resources

**10. What is HIV?**

HIV stands for Human Immuno-deficiency Virus and is a virus that can damage the body's defence system so that it cannot fight off certain infections.

**11. What is AIDS?**

AIDS stands for (Acquired Immuno Deficiency Syndrome). An HIV infected person receives a diagnosis of AIDS after developing one of the AIDS indicator illness, A positive HIV test result does not mean that person has AIDS. A diagnosis of AIDS is made by a physician using certain clinical criteria (Eg: AIDS indicator illnesses).

**12. What is opportunistic infection?**

Infection with HIV can weaken the immune system to the point that it has difficulty fighting off certain infections. These types of infections are known as "opportunistic infections" because they take the opportunity to weaken the immune system which causes illness of the body.

**13. List the means of HIV transmission.**

There are four main ways in which HIV can be passed on:

- a. By having vaginal, anal or oral sex without a condom with someone who has HIV.
- b. By using needles, syringes or other drug-injecting equipment that is infected with HIV.
- c. From a woman with HIV to her baby (before or during birth) and by Breast feeding.
- d. By receiving infected blood, blood products or donated organs as part of medical treatment.

**14. Name some tests available to find HIV infection.**

- a. In addition to the EIA or ELISA and Western blot, other tests now available include:
- b. Radio Immuno Precipitation Assay (RIPA)
- c. Dot –blot immuno binding assay
- d. Immuno fluorescence assay
- e. Nucleic acid testing
- f. Polymerase Chain Reaction (PCR)

**15. List the special features of Comprehensive programme on women and child welfare.**

- a. Personality.
- b. Reduction of Deprivation.
- c. Co-ordination Effectivity.
- d. Maternity and Motherhood.

**16. Name some applications of IT in health.**

Apart from helping in the administration of hospitals, IT is playing a key role in the health industry. On the, medical care, the IT has varied applications right from the diagnosis, where there are latest tools like CT scans, Ultrasound Sonography etc. Which use It as their basis for diagnosis of ailments. Most of the ICU"s (Intensive Care Units) are now using computers to monitor the progress and condition of the patient, undergoing treatments. Apart from this, with help of IT, expert opinions from doctors away from the place can be sought with help of IT tools like video conferencing etc. Apart from this can be used in the analysis and research on various potential medicines /drugs to be used in medical treatments.

**17. List the applications of IT in environment.**

- a. Remote Sensing
- b. Geographic Information System (GIS)
- c. Global Positioning System(GPS)
- d. Meterology

**18.What is information?**

The term "information" has been defined by Eliahu Hoffinan as: "an aggregate (Collection and accumulation) of statements, or facts or figures which are conceptually by way of reasoning, logic,ideas, or any other mental "mode operation" interrelated/connected.

**19.Write short notes on common property resources.**

Our environment has a major component that does not belong to individuals. There are several commonly owned resources that all of us use as a community. The water that nature recycles, the air that we all breathe, the forests and grasslands which maintain our climate and soil, are all common property resources.

**20. What is health?**

Health is considered as a quality of life that enables the individual to live most and serve best.

**21.Define dilution factor.**

The dilution factor is defined as the ratio of the amount of river water to the amount of the sewage.

**16 marks**  
**Unit I- Environment, Ecosystems and**  
**Biodiversity**

**Part- B(16 marks)**

- 1.(i) Explain the various threats to Biodiversity.  
(ii) What are the causes for loss of biodiversity?
- 2.( i) What is meant by value of biodiversity? Explain different values of biodiversity.  
(ii) Explain In-situ and Ex- situ conservation of biodiversity.
- 3)( i) Explain the role of biodiversity of global, national and local levels.  
(ii) Describe the term hot spot in biodiversity
- 4.(i) Briefly explain the energy flow through ecosystem.  
(ii) Describe the types, characteristic features, structures and function of Forest ecosystem,
- 5.(i) Discuss the concept of ecological succession.  
(ii) Briefly explain the structural and functional components of an ecosystem.
6. (i) Write a note on endangered and endemic species.  
(ii) Explain the scope and significance of environmental studies.
- 7.i) Name and briefly describe two hot spots of biodiversity in India  
ii) Describe the types, characteristic features, structures and function of aquatic ecosystem.
8. i) Discuss the major features, structure and composition of grassland ecosystem.  
ii) Discuss the structure and composition of fresh water ecosystem.
- 9 i) What are the cycles in ecosystems? Describe carbon cycle.  
ii) Give the classification and explain various levels of biodiversity.
- 10 i) Discuss the structure and function of desert ecosystem.  
ii) Discuss the biogeochemical cycle in the ecosystem.

**Unit II -Environmental Pollution**

**Part- B (16 marks)**

- 1.(i) Explain the methods of disposal of municipal solid waste.  
(ii) Write a note on disposal of radioactive wastes.
2. (i) Explain the causes, effects and control measures of water pollution.  
(ii) Explain the effects of nuclear and Radiation pollution.
3. (i) Explain the causes, effects and control measures of marine pollution.  
(ii) Write a short note on disaster management.
4. (i) Discuss the major soil pollution and their impact.  
(ii) What is thermal pollution and explain its effects.
5. (i) Discuss about the significance of hazardous waste management.  
(ii) Discuss the major air pollutants and their impact.
6. (i) Describe the sources, effects and control of noise pollution.  
(ii) Discuss the role of individual in preventing pollution.
- 7(i) What is acid rain? How it is formed? Give its effects.  
(ii) What is ozone? How it is depleted? Enumerate the effects of ozone layer depletion.
- 8(i) Discuss in detail about waste water treatment process.  
(ii) Discuss the role of individual in prevention of pollution.
- 9(i) Draw the flow chart for solid waste management and give the sources of it.  
(ii) Discuss in detail about the Bhopal gas tragedy and Chernobyl nuclear disaster.
10. (i) How is the water treated by zeolite process.  
(ii) Explain in detail about the demineralization process.

**Unit III- Natural Resources**

**Part- B (16 marks)**

- 1.(i) Discuss briefly the ill-effects of deforestation.  
(ii) What are the effects of modern Agriculture?
2. (i) What are the causes of soil erosion & deforestation? Explain in detail.  
(ii) Discuss the consequences of overutilization of surface and Ground water.
3. (i) Write the effects of extracting and using mineral resources  
(ii) Discuss the causes of land degradation.

4. (i) Explain how the alternate energy sources play an important role in environment impact.  
(ii) Write a note on solar production of electricity.
5. (i) Explain the role of an individual in environment protection.  
(ii) Explain the methods of harnessing wind and ocean thermal energy.
6. (i) Compare nuclear power with coal power.  
(ii) Write briefly on the Hydrologic Cycle.
7. (i) What are the ecological benefits of forest?  
(ii) Environmental damage caused by mining last longer after the mine has closed – explain.
8. (i) Discuss the effects of dams on forest and tribal people.  
(ii) Explain the benefits and problems of constructing dam.
9. (i) Explain any two water conflicts confining to India.  
(ii) Explain various steps involved in anaerobic digestion.
10. (i) Explain the production and uses of biogas  
(ii) Write notes of bioconversion of pollutants and degradation of proteins.

#### **UNIT IV- Social Issues and the Environment**

##### **Part- B (16 marks)**

1. (i) Explain the agenda for sustainable development.  
(ii) Explain the need and strategy of water conservation.
2. (i) Explain wasteland reclamation.  
(ii) Discuss nuclear accidents and holocaust.
3. (i) Define environmental ethics. Mention the problems and solutions related to environment  
(ii) Explain briefly on the Indian Environmental Acts.
4. (i) Explain watershed management.  
(ii) Explain rain water harvesting.
5. (i) Explain resettlement and rehabilitation issues.  
(ii) Explain the urban problems related to energy.
6. (i) Give the principles of Green chemistry.  
(ii) How is environment protected through Legislation? Explain.
7. (i) What is consumerism? Mention the objectives and factors affecting consumerism.  
(ii) Explain in detail on environment and water act.
8. (i) What is a biomedical waste? Give the steps involved in management of biomedical waste.  
(ii) What is an eco mark? Give the objectives of it. Give the criteria for awarding eco mark.
9. (i) Give the drawbacks of environmental laws.  
(ii) What is an earthquake? Enumerate its effects. Mention the methods to mitigate the disaster.
10. (i) Explain various emergency management tips to be under taken in case of any disaster.  
(ii) State different natural calamities and explain one in detail.

#### **UNIT V- Human Population and the Environment**

##### **Part- B (16 marks)**

1. (i) Explain briefly the population explosion.  
(ii) Explain the role of IT in environment and human health. ' '
2. (i) Explain in detail about population growth.  
(ii) Explain in detail about family welfare programme, training and development.
3. (i) Explain the value of education.  
(ii) Explain briefly on Human rights.
4. (i) Explain HIV/AIDS.  
(ii) Explain the various policies and programmes for women and child development.
5. (i) Write short notes on a) women and child welfare b) Human rights c) Value education.  
(ii) Outline the various family welfare plans in the post independent India.
6. (i) Explain the role of NGOs in environmental protection and health.  
(ii) Discuss about the environmental and social problems faced by a large Indian city like Chennai.
7. (i) Draw a typical population pyramid of a developing country and discuss how it differs from that of a developed country.  
(ii) Deterioration of environment leads to Deterioration of human health. – Justify.

- 8(i) Write in detail on implementing family planning programme.  
(ii) Discuss the factors influencing family size.
- 9(i) Population explosion leads to environmental deterioration. Explain.  
(ii) Write a note on various methods of family planning.
- 10(i) With a neat diagram explain the variation in population growth among various nations.  
(ii) What is EIA? Give the objectives, benefits and process of EIA.

### ASSIGNMENT QUESTIONS

1. What is an ecosystem? Describe the structure and function of various components of an ecosystem.
2. Discuss the threats faced by Indian biodiversity and write a note on conservation of biodiversity.
3. Elaborately discuss the steps involved in solid waste management.
4. "India is a mega diversity nation"-Discuss.
5. Indicate the causes and effects of water pollution.
6. Discuss the source, effects and control measures of thermal pollution.
7. Explain in detail about the problems of fertilizers and pesticides on modern agriculture.
8. Discuss the production of biogas. Mention its uses.
9. Describe the causes and effects of deforestation.
10. What is land degradation? Discuss the factors responsible for land degradation.
11. Write short notes on following act
  - (i) Water prevention and conservation act, 1974
  - (ii) Forest conservation act, 1980.
12. Write short notes on Air act, 1981.
13. What are the modes of transmission of HIV? And how can it be prevented.
14. List the causes, effects and control measures of population growth.
15. Briefly describe the various schemes launched for women and child welfare in India.
16. Explain the role of IT in environmental and human health.
17. What is value education and write the methods and strategies of imparting value education.

**CE 6301 –ENGINEERING GEOLOGY**  
**TWO MARK QUESTIONS AND ANSWERS**  
**UNIT – I**  
**PHYSICAL GEOLOGY**

**1. Define engineering geology.**

Engineering geology may be defined as that branch of applied sciences which deals with the application of geology for a safe, stable and economical design and construction of civil engineering projects.

**2. Define exfoliation.**

**Exfoliation** results when rocks formed at depth are exposed at the ground surface; the previous compressional forces would decrease and thus allow the rock to expand by fracturing parallel to the surface.

**3. What is meant by littoral drift?**

These are bodies of sea water moving along and parallel to the sea shore. They are produced by waves striking against the shore rocks.

**4. Describe briefly the exterior and interior of the earth.**

Interior of the earth: 1) Crust 2) Mantle 3) Core

Exterior of earth: 1) Atmosphere 2) Hydrosphere 3) Lithosphere

**5. Define Continental Drift.**

Accumulation of glacial debris directly from glacial melt waters are collectively called continental drift.

**6. Write short notes on Mercalli Scale.**

The intensity of earthquake can be measured with the help of Mercalli scale their measurements are expressed for degree of vibration.

**7. Define weathering. Name the different types of weathering.**

The term weathering means, the process of physical is breaking up (i.e., Disintegration) and chemical breaking up (i.e., Decomposition) of rock occurring simultaneously.

**8. What is meant by physical weathering?**

It is a natural process of disintegration of rocks into smaller fragments and particles without inducing any chemical change in the end product. It is one of very common processes of slow rock disintegration in all parts of the world.

**9. What is meant by chemical weathering?**

It is a process of alteration of rocks of the crust of the Earth by chemical decomposition brought by atmospheric gases and moisture. Chemical weathering is therefore, essentially a process of chemical reactions between the gases of atmosphere and surface of the rock.

**10. What is meant by spheroidal weathering?**

It is a complex type of weathering observed in jointed rocks and is characterized with breaking of the original rock into spheroidal blocks. Both chemical and physical processes are believed to operate in spheroidal weathering.

**11. Explain deflection in erosion in wind.**

In this process, loose particles are removed by flowing winds. The blowing wind lift up the loose, Dry and incoherent rock particles, except hard and compact masses, which remains in their original position.

**12. What are the factors depends on the intensity of running water.**

Velocity of the water, Nature of the soil over which the water runs, Load conditions of the rainy water.

**13. Define divergent movement.**

The boundaries of two adjoining large plates move away from each other there by creating a gap through this gap the hot lava comes out.

**14. Define convergent movement.**

The boundaries of two large plates move towards each other plate and push the latter upwards in front of the mountain.

**15. What are the factors depends on the intensity of wind erosion.**

Nature of region over which the wind flow, Velocity of the wind.

**16. Define Confined and unconfined aquifer.**

- When an **aquifer** is encased on its upper and under surface by impervious rock formation, and is also broadly inclined so as to expose the aquifer.
- **Unconfined aquifer** also called no artesian aquifers, are the top-most water bearing strata having no confined impermeable over-burden lying over them.

**17. Differentiate between water table and perched water table.**

- The contact between the saturated and unsaturated zones is called the **water table**
- A **perched water table** is an accumulation of groundwater that is above the water table in the unsaturated zone

**18. Define Plate Tectonics.**

Plate Tectonics is based primarily due to seismic and geomagnetic activities. In this concept, the upper part of the earth up to a depth of 100 km is actually divided into seven to ten major blocks called plates.

**19. Name a few secondary tectonic plates.**

1) Transform boundaries 2) Divergent boundaries 3) Convergent boundaries 4) Plate boundary zones

**20. Define aquifer.**

It is defined as a rock mass, a layer or formation which is saturated with ground water and yielding the stored water at economical costs when tapped. The quality is depending on the amount of water bearing capacity rate of yield gravels etc.

**21. List four depositional landforms created by river.**

1) Alluvial fans and cones 2) Flood plain deposit 3) Convex flood plain 4) Flat flood plain 5) Deltas.



## **22. List four depositional landforms created by wind.**

Sediments once picked up by the wind from any source on the surface are carried towards to varying distance depending on the carrying of the wind.

**1) Dunes 2) Barchans 3) Sigmoidal dune 4) Transverse dune 5) Loess**

## **23. What is meant by seismic zones mention the seismic zone of India?**

A seismic zone is a region in which the rate of seismic activity remains fairly consistent. This may mean that seismic activity is incredibly rare, or that it is extremely common. Some people often use the term “seismic zone” to talk about an area with an increased risk of seismic activity.

- Zone - II: This is said to be the least active seismic zone.
- Zone - III: It is included in the moderate seismic zone.
- Zone - IV: This is considered to be the high seismic zone.
- Zone - V: It is the highest seismic zone.

## **UNIT- 2 MINERALOGY**

### **1. Define mineralogy.**

Mineralogy is a branch of geology which deals with formation, occurrence, aggregation, properties, and uses of minerals. It is divided into specific sub branches such as crystallography, optical mineralogy and descriptive mineralogy and so on.

### **2. Name the physical properties of minerals.**

Colour, lustre, Streak, Hardness, Cleavage, Parting, Fracture, Tenacity, Structure, Specific gravity, form, Miscellaneous.

### **3. What is meant by luster?**

It is defined as the shine of a mineral. It is technically defined as the intensity of reflection of light from the mineral surface and depends at least on three factors.

### **4. What is meant by Streak?**

It is an important and diagnostic property of many colored minerals. It is defined as the colour of the finely powdered mineral as obtained by scratching or rubbing the mineral over a rough unglazed porcelain plate. The plate is often named as streak in a geology laboratory.

### **5. What is meant by Fracture?**

The appearance of broken surface of a mineral in a direction other than that of cleavage is generally expressed by the term fracture.

### **6. What is meant by Cleavage?**

It is defined as the tendency of a crystallized mineral to break along certain definite direction yielding more or less smooth, plane surfaces.

### **7. What is Moh's scale of hardness?**

The Moh's scale of mineral hardness is a qualitative ordinal scale which characterizes the scratch resistance of various minerals through the ability of a harder material to scratch a softer material.

**8. Give the physical properties and uses of quartz group.**

S.No	physical properties	quartz group
1.	colour	Black,pink,yellow
2.	Hardness	7
3.	Specific gravity	2.65
4.	Uses	Manufacturing glass, optical instruments

**9. Write the important minerals from feldspar group and their uses.**

S.No	Name of feldspar minerals	Uses
1.	Albite	glassmaking
2.	Anorthite	ceramics
3.	Orthoclase	extender in paint,
4.	Microline	extender in plastics, and rubber

**10. Give the physical properties and uses of hypersthene and augite.**

S.No	physical properties	Hypersthene	Augite
1.	colour	Green, black	Black dark, green
2.	Hardness	5 to 6	5 to 6
3.	Specific gravity	3.4 to 3.5	3.4 to 3.5
4.	Uses	Making gem stones	Making gem stones

**11. Give the physical properties and uses of hornblende.**

S.No	physical properties	Amphibole group (hornblende)
1.	colour	Black, dark green
2.	Hardness	5
3.	Specific gravity	2.9 to 3.4
4.	Uses	Manufacturing cement

**12. Give the physical properties and uses of muscovite and biotite.**

S.No	physical properties	Muscovite	Biotite
1.	colour	white	Brownish black
2.	Hardness	2.7 to 2.9	2.9 to 3.1
3.	Specific gravity	3	3
4.	Uses	Insulating material	Manufacturing cement

**13. Give the physical properties and uses of calcite.**

S.No	physical properties	calcite
1.	colour	White or colourless
2.	Hardness	2.5 to 3
3.	Specific gravity	2.7
4.	Uses	Manufacturing cement, making prisms

**14. Give the physical properties and uses of gypsum.**

S.No	physical properties	gypsum
1.	colour	clear, colourless, white, grey
2.	Hardness	2
3.	Specific gravity	2.3

4.	Uses	Use to manufacture dry wall, plaster
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**15. Bring out the differences between streak and colour of mineral.**

Streak is the color of a crushed mineral's powder. The color of a mineral's powder may differ from the actual color of the mineral. This property can be useful for mineral identification. A streak is useful in distinguishing two minerals with the same color but different streak. A good example is distinguishing Gold (yellow streak), and Chalcopyrite (black streak).

**16. Name at least 4 clay minerals and their important engineering properties.**

S.No	Name of clay minerals	Engineering properties
1.	<b>Bentonite clay</b>	Decolorized of oils
2.	<b>China clay</b>	White colour
3.	<b>Ball clay</b>	Large in silica content
4.	<b>Fire clay</b>	Good plasticity

**17. Define clay mineral.**

Clay minerals are mainly formed due to alterations or decomposition(break down) of the pre-existing silicate minerals.eg) kaolinite, halloysite.

**18. Define specific gravity.**

A mineral's specific gravity is the ratio of its mass to the mass of an equal volume of water. For example, magnetite has a specific gravity value of 5.2, meaning 1cm<sup>3</sup> of magnetite will be 5.2 times as heavy as 1cm<sup>3</sup> of water.

### UNIT 3 PETROLOGY

**1. Define Igneous Rocks.**

All rocks that have formed from an original hot, molten material through the process of cooling and crystallization may be defined as Igneous Rocks.

**2. Explain about Hypabyssal Rocks.**

These Igneous Rocks are formed at Intermediate depths, generally up to 2 Km, below the surface of earth and exhibit mixed characteristics of volcanic and plutonic rocks. Porphyries of various compositions are example of Hypabyssal Rocks.

**3. Define Texture of Igneous Rocks.**

The term texture has been defined as the mutual relationship of different mineralogical constituents in a rock. It is determined by size, shape and arrangement of these constituents within the body of rock.

**4. What are the factors Explaining Texture?**

- a) Degree of Crystallization  
Holocrystalline, Holohyaline.
- b) Granularity  
Coarse grained, Medium grained, Fine grained.

- c) Fabric  
Panidiomorphi, Allotrimorphic, Hypidiomorphie.

**5. Define Equigranular and Inequigranular Texture.**

All those textures in which majority of constituent crystals of rock are broadly equal in size are described as equigranular textures. All those textures in which majority of constituent minerals show marked difference in their relative grain size are grouped as inequigranular textures.

**6. Define Structure of Igneous Rocks.**

Those features of Igneous Rocks that are developed on a large scale in the body of an extraction or intrusion giving rise to conspicuous shapes or forms are included under the term structures. They may be so well developed as to be recognized easily on visual inspection or they become apparent only when this section of such rocks is examined under microscope. In latter case they are termed microstructure.

**7. What are the factors depending on Igneous Rocks?**

- a) The structural deposition of the host rock (also called country rock).
- b) The viscosity of the magma or lava.
- c) The composition of the magma or lava.
- d) The environment in which injection of magma or eruption of lava place.

**8. Define Volcanic Necks.**

In some cases, vents of quiet volcanoes have become sealed with the intrusion, such intrusions are termed volcanic Necks or Volcanic Plugs. These masses may be circular, semi-circular or irregular and show considerable variation in their diameter.

**9. Define Sedimentary Rocks.**

Sedimentary are also called secondary Rocks. This group includes a wide variety of rocks formed by accumulation, compaction and consolidation of sediments; particles are remaining of organisms in suitable environment under ordinary condition of temperature and pressure.

**10. What are the Structures Sedimentary Rocks?**

- a) Mechanical Structures  
Stratification, Lamination, Cross Bedding, Graded Bedding, Mud Cracks, Rain Prints, Ripple Marks.
- b) Chemical Structure  
Concretionary Structure, Oolitic and Pisolitic Structures, Nodular Structure, Geode Structure.
- c) Organic Structures.

**11. What is the Classification of Sedimentary Rocks?**

- a) Clastic Rocks
  - ☐ Gravels  
Boulders, Cobbles, Pebbles.
  - ☐ Sands  
Rudites, Arenites, Lutites.
- b) Non Clastic Rocks
  - ☐ Chemically formed rocks

c) Miscellaneous Deposits.

**12. Explain metamorphic changes.**

All the changes in the body of rocks that are due to variations in the factors of pressure, temperature and chemical environment are known as metamorphic changes and the process itself is termed metamorphism.

**13. What are the kinds of Metamorphism?**

Three major kinds of Metamorphism differentiated on the basis of dominant factors are thermal metamorphism, dynamic metamorphism and Dynamic thermal metamorphism.

**14. Define Metamorphism.**

It is defined as a metamorphic process involving formation of new minerals by the mechanism of chemical replacement of the pre-existing minerals, chiefly under the influence of chemically active fluids.

**15. What is the factor which depends on the effects of Metamorphism?**

- a) The types of rocks involved in the process
- b) The kind of metamorphism that is predominant in the process.

**16. Define Metamorphic Rocks.**

Metamorphic rocks are defined as those rocks in which have formed through the operation of various types of Metamorphism processes on the pre-existing rocks involving either textural or structural changes or changes in mineralogical composition or reconstitution in the both the directions.

**17. Define petrology and classification of petrology.**

The study of Rock is known as petrology. The rocks of the crust can be divided into three types i) Igneous rock ii) Sedimentary rock iii) Metamorphic rock

**18. Define Slate.**

Slate is an extremely fine grained metamorphic rocks characterized by a slaty cleavage by virtue of which it can be split in to thin sheets parallel smooth surfaces, The slaty cleavage is due to parallel arrangement of platy and flaky operating during the process of metamorphism

**19. Define Schist.**

Schist is megascopically crystalline metamorphic rocks characterized by typical schistose structure. The constituent platy and Flaky minerals are mostly arranged in irregular parallel layers or bands.

**20. Define Granites.**

Granite may be defined as plutonic light colored igneous rocks. These are among the most common igneous rocks. The word Granite is derived from Latin word granum meaning a grain and obviously refers to the equigranular texture of the rocks.

**21. What is meant by RMR? What is its significance?**

The Rock Mass Rating (RMR) System is a geo-mechanical classification system for rocks It combines the most significant geologic parameters of influence and represents

them with one overall comprehensive index of rock mass quality, which is used for the design and construction of excavations in rock, such as tunnels, mines, slopes and foundations.

## 22. Differentiate between Gneiss and schist?

S.No	Properties	Gneiss	Schist
1.	Rock	Metamorphic rock	Metamorphic rock
2.	Colour	White to black	Variety of colours
3.	Texture	coarse grained	coarse grained, schistose
4.	Uses	Concrete, road aggregates	Source of minerals

## 23. Define crushing strength of rock?

The **crushing strength** of rock, determined by breaking a cube, and often called the cube strength, reaches values of about 3 tons per square inch, that of granite 10 tons per square inch, and that of cast iron from 25 to 60 tons per square inch.

## 24. Write short notes on slate as a building stone.

Slate is an extremely fine grained metamorphic rocks characterized by a slaty cleavage by virtue of which it can be split in to thin sheets parallel smooth surfaces, the slaty cleavage is due to parallel arrangement of platy and flaky operating during the process of metamorphism.

## 25. Explain graded bedding?

Graded bed is one characterized by a systematic change in grain or clast size from the base of the bed to the top. Most commonly this takes the form of normal grading, with coarser sediments at the base, which grade upward into progressively finer ones.

## 26. Mention the composition, properties and uses of dolerite?

S.No	Properties	dolerite
1.	Rock	Igneous rock
2.	Colour	Dark such as grey or black
3.	Texture	Fine grained texture
4.	Uses	Sources of fossils

## 27. Differentiate between shale and quartzite.

S.No	Properties	shale	quartzite
1.	Rock	Sedimentary rock	Metamorphic rock
2.	Colour	Red, grey, green, purple, black	White, grey, yellowish
3.	Texture	Fine grained texture	Fine grained texture
4.	Uses	Sources of fossils	Concrete, road aggregates

## 28. Differentiate between sandstone and quartzite.

S.No	Properties	sandstone	quartzite
1.	Rock	Sedimentary rock	Metamorphic rock
2.	Colour	Reddish, greenish, brownish	White, grey, yellowish
3.	Texture	Fine grained texture	Fine grained texture

4.	Uses	Building stones, tiles	Concrete, road aggregates
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## 29. What is meant by slaty cleavage?

Slaty cleavage is defined as having 0.01 mm or less of space occurring between layers. Slaty cleavage often occurs after diagenesis and is the first cleavage feature to form after deformation begins. The tectonic strain must be enough to allow a new strong foliation to form, i.e. slaty cleavage.

## UNIT 4 STRUCTURAL GEOLOGY AND GEOPHYSICAL METHOD

### 1. Define Dip.

The inclination of the bedding planes, with the horizontal, is called dip and is always expressed in degrees.

### 2. Explain true dip.

It is the maximum inclination of bedding planes with the horizontal, or in other words it is the inclination of the direction of which water would flow, if poured on the upper surface of the bed.

### 3. Explain apparent dip.

The inclination of the bedding planes, with the horizontal, in any other direction, other than the direction of the true dip, is known as the apparent dip. The value of apparent dip is always less than the true dip.

### 4. Define strike.

It is the direction, measured on a Horizontal surface, of a line formed by the intersection of dipping bed with the horizontal plan. It is always expressed in terms of main direction i.e., is North, South, East or West.

### 5. What is meant by folds?

The earth's crust is tilted out of the horizontal and is bent into folds. Such a fold may range from a microscopic crinkle to great arches and troughs even up to 100 kms across. A set of such arches and troughs is called a fold.

### 6. What is meant by Anticline and Syncline?

When the beds are unfolded in an arch-like structure, it is called an anticline. When the beds are down folded in trough like structure, it is called a Syncline. It may be noted that in an anticline the oldest rock is in the centre, whereas in a syncline the youngest rocks are in the centre.

### 7. Explain Causes of folding.

The interior of the earth is getting cooler and cooler day by day, which is sure to cause some shrinkage in the earth's crust. This shrinkage is responsible for the compressive and shearing stress to be developed within the earth's crust. Some times these stresses are small in magnitudes but go on exerting pressure for a sufficient length of time and result in buckling or folding of the layers of the earth's crust.

### 8. What are types of folds?

- a) Symmetrical fold
- b) Asymmetrical fold
- c) Overturned fold
- d) Isoclinal fold
- e) Recumbent fold
- f) Plunging fold
- g) Open fold
- h) Closed fold
- i) Anticlinorium
- j) Synclinorium
- k) Dome
- l) Basin
- m) Nonoclinalfold.

### **9. Define Faults.**

Faults are fractures, along which the movement of one block with respect to other, has taken place. This movement may vary from a few centimetres to many kilometres depending upon the magnitude of the stresses, and the resistance offered by the rocks.

### **10. Explain the Causes of Faulting?**

Faults are essentially the shear or sliding failures, resulting from tensional, compressional, or rotational stresses acting on the crustal rock masses. This movement may vary from a few centimetres to many kilometres depending upon the magnitude of the stresses, and the resistance offered by the rocks.

### **11. What are the classifications of faults?**

Faults are classified on the basis of their apparent displacement, ie, the direction of movement, of one block, with respect to the other along the fault plane.

### **12. What are the criteria for the recognition of a fault?**

- 1) Discontinuity of strata
- 2) Repetition and omission of strata
- 3) Physiographic features
- 4) General.

### **13. What is mean by Joints?**

When sufficient tensile stress is developed between two successive points, a crack is developed at right angle to the direction of the stress, such cracks are called joints.

### **14. What is mean by Master joints?**

The joints always occur in sets and groups. A set of joints means, joint occurring in the same dip or strike. A group of joints means a few sets of joints having almost the same trend. If a few sets or groups of joints appear for a considerable length in a rock, such joints are called major joints or master joints.

### **15. Define out crop.**



A little consideration will show that the out crop of a rock is affected by the angle of dip also. If a rock has a vertical dip then the outcrop will be less, than that when the same rock is dipping at some angles.

**16. What are the different forms of out crops?**

- a) Out lie
- b) In lie
- c) Unconformity
- d) Overlap
- e) Cross bedding.

**17. Define over lap.**

An over lap is particular type of an unconformity, in which the overlying strata extends so as to over lap the underlying strata.

**18. Define cross bedding.**

Sedimentary beds or layers are generally parallel to one another. But, sometimes, it has been observed that the beds lie slightly oblique to the major bedding planes.

**19. What are the classifications of joints?**

- a) Geometrical classification  
Strike joints, Dip joints, Oblique joints
- b) Genetic classification  
Tension joints, shear joints

**20. What are the methods of Geophysical Exploration?**

Depending upon the type of energy field used, the following methods may be used. Seismic method, Electrical method, Gravitational method, Magnetic method, radiometric method, geothermal method.

**21. What is normal fault?**

A normal fault is the one in which the hanging wall has apparently moved down with respect to the footwall. The fault planes of majority of normal faults dip more than 45 degree.

**22. Explain the mural and sheet joint structures.**

- Sheet joints are horizontal joints developed in massive igneous rocks, especially granites.
- Mural joints are combination of columnar joints, mud cracks, and sheet joints, mutually perpendicular to one another, developed generally in igneous rocks, such as granites.

**23. Define the term Rock Quality Designation.**

It is the borehole core recovery percentage incorporating only pieces of solid core that are longer than 100 mm in length measured along the centreline of the core.

**UNIT-5**  
**GEOLOGICAL INVESTIGATIONS IN CIVIL ENGINEERING**

### **1. Define remote sensing.**

Remote sensing is the science and art of obtaining information about an object, area, or phenomena through the analysis of data acquired by a device that is not in contact with the object, area, or phenomena under investigation.

### **2. What is meant by aerial photography & Imageries?**

The photographs of the earth taken from aircrafts are called the aerial photographs, while the pictures taken from the satellites are called the imageries.

### **3. Define aerial photographs.**

Aerial photographs of the region are taken by cameras placed in the aircrafts. Aerial photos give three dimension of the photographed area. These photos contain a detailed record of the ground at the time exposure.

### **4. Define satellite imageries.**

The satellite imageries can either be read manually like aerial photographs, or with the help of computers.

### **5. What is meant by lineament?**

A **lineament** is a linear feature in a [landscape](#) which is an expression of an underlying [geological structure](#) such as a [fault](#). Typically a lineament will comprise a fault-aligned valley, a series of fault or fold-aligned hills, a straight coastline or indeed a combination of these features.

### **6. What are applications of remote sensing?**

General geological mapping, mineral prospecting, petroleum exploration, ground water exploration, engineering uses of site rocks, disaster studies, coastal geological studies.

### **7. What are geological considerations involved in the construction of buildings.**

Basic requirements of a building foundation, building foundation on soils, building foundation carried to the deep hard rocks, building founded on surface bed rocks, types of settlement in buildings.

### **8. What are the characteristics of air photos?**

Shape and size, flight and photo data, scale.

### **9. What are the kinds of air photos?**

Vertical air photos, oblique air photos, mosaics, photostrips, stereopair.

### **10. Define slump.**

A slump is a form of mass wasting that occurs when a coherent mass of loosely consolidated materials or rock layers moves a short distance down a slope.

### **11. What is meant by measuring dots?**

A stereo meter consists of two small transparent glass or plastic plates attached to a long metallic bar. A clear dot is etched on each of the plates called "measuring dots".

### **12. Define land slide.**

A land slide is a slow or sudden downhill movement of slope forming rock and soil materials under the force of gravity.

**13. Places in which land slide occur.**

They occur in hill valley slopes, sea coasts, river banks and bends, on the slopes of volcanic cones and in earth quake prone areas. They also occur under water as on lake or sea floor.

**14. What are the classifications of landslides?**

Presence or absence of a definite slip plane, materials involved and their water content, kind and rate of movement.

**15. What are the parts of atypical slides**

Crown, scrap, head, slip plane, flanks, transverse ridges, fool, toe, length, width, height, depth.

**16. What are the types of land slides?**

- (1) Slides:  
Translational, Rotational
- (2) Falls
- (3) Flows  
Slow, Soil creep, Rock creep
- (4) Complex slides.

**17. What are the characteristics of land slide?**

- 1, Steep scraps in their upper parts and irregular ridges and furrows at lower parts.
- 2, Land slides vary in extent from several square meters to several kilometers. Its thickness may several meters.
- 3, Land slide velocities ranges from very small movement to more than 100 km/h.

**18. What are the causes of land sides?**

- a) Natural causes.
  - 1, Internal factors.
  - 2, External factors.
- b) Man induced causes.

**19. What are the Geological considerations involved in Road cutting?**

- a. Topography
- b. Lithological characters
- c. Structural features of the rocks
- d. Ground water conditions

**20. What are the structural features of tunnel sites?**

- a. Dip and strike
- b. Folds
- c. Faults
- d. Joints.

**21. What is meant by stand-up time tunnelling?**

Stand-up time is the amount of time a tunnel will support itself without any added structures. Knowing this time allows the engineers to determine how much can be excavated before support is needed. The longer the stand-up time is the faster the excavating will go.

**22. Define over break in tunnelling operations.**

The excess cutting than what is required for the designed section of the proposed tunnel is known as the over-break. The geological factors which govern the over break are i) the nature of the rock ii) the orientation and spacing of joints of weak zone.

**23. Give the functions of breakwater.**

Breakwaters are structures constructed on coasts as part of [coastal defence](#) or to protect an anchorage from the effects of both [weather](#) and [long shore drift](#). It is used to reduce the intensity of wave action in inshore waters and thereby reduce [coastal erosion](#).

**24. What is the function of groynes in coastal protection?**

Groynes are a barrier type wooden, steel, stone or concrete structures high or low, long or short, permeable or impermeable which extend from into the littoral zone.

Groynes intercept and trap littoral drift moving into the area and widen the beach at the location and thus minimize sand losses.

**25. Describe the seawall and jetties in coastal protection structures**

- Seawalls are massive rigid masonry, concrete or steel sheet pile structures built to protect land from sea erosion.
- Jetties are similar to groynes constructed at inlets to control sand movement and improve navigation facilities.

**16 MARK QUESTIONS****UNIT – I  
PHYSICAL GEOLOGY**

1. Explain in detail about the process of weathering of rocks and its relevance to engineering geology.
2. Give a detailed account of the geological work of the sea. Add a note on importance of geology in coastal Engineering.
3. Give a detailed account of the erosional and depositional landforms created by the action of a river.
4. Write an essay on the erosional and depositional features of wind.
5. Describe the theory of plate tectonics.
6. Give a detailed account of the origin, distribution and properties of ground water.
7. Explain the concept of plate tectonics and describe its relation to seismicity.
8. Give an elaborate account of plate tectonics and its relevance to earthquake engineering including the earthquake belts of India.

**UNIT- 2  
MINERALOGY**

1. Using examples list and describe the important physical properties of minerals.

2. Discuss about the chemical composition, physical properties, origin, varieties and uses of quartz.
3. Briefly describe the feldspar group of minerals.
4. Explain in detail about the pyroxene group of minerals.
5. Elaborate on the composition, physical properties, mode of origin, uses of
  - i) Amphibole and its varieties.
  - ii) Mica and its varieties.
  - iii) Gypsum.
6. Give a detailed account on chemical composition, physical properties, origin, occurrence, engineering behavior and uses of clay minerals.

### **UNIT 3 PETROLOGY**

1. How are rocks classified? Describe the major distinguishing properties of the major rock types.
2. Give the mode of occurrence, mineral composition, engineering properties and uses of the following rocks
  - i) Granite    ii) Basalt    iii) Dolerite    iv) Sandstone
3. Give the mode of occurrence, mineral composition, engineering properties and uses of the following rocks
  - i) Limestone    ii) Laterite    iii) Shale    iv) Quartzite
4. Give the mode of occurrence, mineral composition, engineering properties and uses of the following rocks
  - i) Marble    ii) Slate    iii) Gneiss    iv) Schist
5. List the various field and laboratory tests to determine the engineering properties of rocks.
6. i) Write elaborately on textural classification of igneous rocks  
 ii) Write notes on engineering importance of igneous rocks.
7. What are sedimentary rocks? Explain the properties of any 4 sedimentary rocks.
8. What are metamorphic rocks? Explain the properties of any 4 metamorphic rocks.
9. What are igneous rocks? Explain the properties of any 4 igneous rocks.
10. Bring out the salient characteristics of igneous, sedimentary and metamorphic rocks.
11. i) Summarize the structure of sedimentary rocks.(8)  
 ii) Write a note on chemical and mineralogical classification of igneous rocks.  
 iii) Write a note on chemical and mineralogical classification of igneous rocks.
12. Describe the structure and textures of igneous rocks.

### **UNIT 4 STRUCTURAL GEOLOGY AND GEOPHYSICAL METHOD**

1. Explain how faults and folds affect the choice of locations for dams and tunnels.
2. What are faults? Explain in detail with sketches on (i) Normal fault (ii) Reverse fault (iii) Strike slip fault (iv) oblique fault
3. What are folds? How are they classified? And write its engineering significance.
4. What are joints? How are they classified? And write its engineering significance.
5. Explain in detail the seismic and electrical method in civil engineering investigation.
6. Explain in detail about Resistivity methods and Wenner configuration. Add a note on its civil engineering applications.

### **UNIT-5 GEOLOGICAL INVESTIGATIONS IN CIVIL ENGINEERING**

1. Explain in detail the role of remote sensing in civil engineering practice and applications.
2. Give a detailed account of the process of sea erosion and list the measures used for coastal protection.
3. Classify landslides and discuss about the causative factors of landslides. Also add a note on the measures of landslides.
4. Define the term tunnel. Explain the geology of tunneling with sketches to show how tunnels can be located in highly disturbed area.
5. What are the geological conditions necessary for design and construction of dams? Explain each condition using diagrams.
6. Give a detailed account of geological conditions necessary for road cuttings

### **ASSIGNMENT QUESTIONS**

#### **ANSWER ALL THE QUESTIONS**

1. Give the civil engineering applications in geology.
2. Bring out the earthquake disaster with case study.
3. Explain the geological action of ground water.
4. Explain different group of minerals with its uses.
5. Briefly give the origin of different types of rocks.
6. Elaborate the engineering properties and uses of different mineral kingdom.
7. Give the engineering properties of different rocks.
8. Explain the laboratory tests for rocks.
9. Briefly explain about the economic properties of different rocks.
10. Write the geological methods for subsurface investigation.
11. Discuss about the classification of faults in different rocks.
12. Discuss about the classification of folds in different rocks.
13. Give the applications of remote sensing technology in civil engineering.
14. Enumerate the landslide disasters with case study.
15. Elaborate the coastal disaster with case study.